THE

# ELECTRICAL REVIEW.

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## ELECTRICAL REVIEW.

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## ELECTRIC VEHICLES.

THE announcement regarding the formation of a Committee of the I.M.E.A. to promote the use of electric automobiles in this country will be received with gratification by all who, like ourselves, have this subject at heart; we have felt it our duty, in the interests of the electrical industry, repeatedly to direct attention to the rapid progress made by the electric vehicle in America, and to point out that the conditions in this country are at least as favourable for its development, and we are glad to know that at last the central-station engineer, who really holds the key of the position, is fully awake to the possibilities of this department of electrical activity.

The Committee originally nominated by the Association was a strong one, and is wisely taking steps to co-opt other members representing important interests concerned in the movement. Moreover, with commendable energy, it has outlined a plan of campaign which seems admirably calculated to further the object which it has in view. The prime essential, as it appears to us, is to make it known that electricity supply authorities are willing to provide adequate charging facilities at rates which will enable the electric vehicle to compete with its rivals on a favourable basis, and to this end common action and uniformity of voltage, standard fittings, &c., are indispensable. These considerations are placed appropriately at the head of the Committee's programme. The provision of charging facilities ought really to precede the introduction of the vehicles, although some time must necessarily elapse before there is any appreciable demand for them; it is obvious that if the supply authorities wait for the vehicles to arrive before they provide the charging stations, the latter will never be required. But the cost in the first instance need not be heavy—a single station in each town of moderate size would suffice for a commencement, and might in many cases be situated at or near the electricity works, thus costing nothing extra for supervision.

Publicity, of course, is of the essence of the scheme, and the Committee is to be commended for recognising its importance. There is no reason for any delay in this respect; steps should be taken at once to acquaint the public with the advantages of the electric vehicle and with the arrangements which are being made as regards garaging and charging, as well as for the supply of suitable vehicles. The proposal that technical assistance be rendered to traders in handling what will be to them a totally new line of business is also a good one, and the standardisation of technical details, the formulation of rules for the maintenance of electric vehicles, and the preparation of maps showing charging stations are equally sound. We would suggest that, in addition to the parades of electric vehicles foreshadowed in the programme, competitions be organised between the various makes and types of vehicle which we hope soon to see on the streets, for there is nothing that appeals so readily to the sporting instincts of the nation as a trial of speed or endurance between rival candidates for supremacy. The enlistment of public bodies as users of electro-

mobiles, and, consequently, witnesses to their good qualities, ought not to present great difficulties; we believe the Post Office was within an ace of adopting electricity as the motive power for its great fleet of London postal delivery vans some years ago, when petrol, however, was victorious by a narrow margin, and the excellent electric ambulances and broughams which silently and smoothly run about the streets have familiarised the London public with the idea of electrical propulsion. The example should be set by the electricity departments themselves; if *they* do not use electricity, how can they ask their customers to do so?

In an early issue we propose to illustrate a collection of examples of American achievements in the development of the electric vehicle, and we shall hold ourselves at the disposal of the Committee, which has formulated so admirable a plan, to assist in the work by every means at our command.

**Municipal Tramways.**

The key-note of the conference of the Municipal Tramways Association, which has been sitting this week at Sheffield, was, as might be expected, motor-'bus competition. But it must not be supposed that there was any suggestion of panic at the inroads made by its rival on the sphere of the tramway; the exaggerated views which have been promulgated in the London daily Press regarding the approaching demise of the tramway system and its supersession by the ubiquitous 'bus are held only by their lay authors and the out-and-out advocates of the motor-'bus, and in the calmer atmosphere of the Provinces the question is considered dispassionately and with due regard to the realities of the case. No one who is familiar with the facts regarding the conditions under which the competition is at present carried on—the carrying capacities of the respective vehicles, their accommodation in wet weather, the heavy burdens that are imposed by law upon the tramways but not upon the omnibuses, the uncompensated destruction of the public roads by the latter, and the peculiar traffic conditions obtaining in London, where the tramways are forbidden to enter the heart of the city—can fail to realise that there is plenty of life in the tramway, and that its abolition would be bitterly regretted by the public were it brought about.

As Mr. A. R. Fearnley pointed out in his excellent presidential address on Wednesday, municipal tramways are by no means at a standstill; not only are numerous extensions under way, but also the cars and their equipment are undergoing continuous improvement, speeds are being increased, and more frequent services provided, while the lot of the employés is being steadily ameliorated. The last B. of T. returns show an increased traffic for the year of no less than 220 million passengers, compared with the previous year's results.

Regarding the future, Mr. Fearnley advocates an open mind, ready to take advantage of all new developments, including the railless trolley system and the motor-'bus itself. While he sees no prospect of the motor-'bus replacing the tramcar for heavy traffic, he recognises its advantages as a feeder to the tramway, and has obtained very satisfactory results with 10 'buses in his own district. We are glad to know that technical data regarding the performance and running cost of these vehicles—so jealously withheld by the big 'bus companies—will shortly be available from the municipalities.

The subject of "Urban Passenger Transport" was dealt with more fully by Mr. J. B. Hamilton yesterday; in his paper he exhaustively discussed the relative costs of motor-'buses and tramcars, so far as they are known, and their respective capabilities for dealing with traffic, and arrived at conclusions highly unfavourable to the former. Further reference to the matter must be deferred to a later issue, and for the present we will close with congratulations to the Association on its exceptionally interesting and useful meeting.

**The Bray Explosion.**

After many days—to be precise, one year and two months since the accident occurred—the Home Office has issued a report on the explosion at the electricity works of the Bray Urban District Council, which resulted in the death of a fitter, most serious injuries to the engineer, Mr. Sowter, and minor injuries to his assistant, Mr. McDonnell. The report is signed by Mr. G. S. Taylor, H.M. Inspector of Factories, under date March 25th, 1913, and is a model of its kind. Pressure on our space forbids its reproduction in this issue, but we shall reprint a large portion of it later. In the meantime, we may say in brief that the Inspector arrived at the conclusion that the explosion of the blast vessel was caused by the ignition of an oily deposit on its interior, due to the transmission of a flame explosion from the fuel valve casing along the blast pipe. The ignition was facilitated, and the resultant explosions were intensified, by the large volume of compressed oxygen contained in the blast vessel and blast pipe, and for this reason oxygen ought not to be used for recharging air vessels. The latter, he says, should be cleaned every 12 months, and tested every four years, and a device should be fitted to prevent the transmission of flame explosions along the pipes.

In our comments on the accident last year, we expressed the view that compressed oxygen in the presence of oil was the root cause of the trouble, and ought never to be used, and that a non-return valve should be inserted in the blast pipe.

**Lead.**

There has been a certain amount of irregularity in the lead market of late, but at such a high level of prices as the present this is only what is to be expected, for the market is bound to be sensitive. Quite a sharp fall occurred when it was found that 100 tons of lead from a non-Convention plant in Belgium had been shipped to London and delivered to a London dealer, for it was at once assumed that this meant that there was a secret stock of the metal available for immediate delivery against speculative contracts. As a matter of fact, it had no special significance, but for all this it brought about pretty plentiful selling, and with not the smallest support, a sharp reaction was witnessed. As usual, the weakness was merely a passing phase, and with a renewed demand from dealers and consumers, and some covering by oversold speculators, a rapid and substantial recovery ensued. For all this, however, it would be well to take a rather cautious view as to the future, for the price is high, and on all hands there are more or less distinct signs of a period of industrial reaction being in progress. This must inevitably involve lower, not higher, prices, and if once the Mexican position cleared up sufficiently to allow of the resumption of shipments on even a small scale, the price of lead would be far below the current level. There is not anything wrong with the position in itself, but it must not be forgotten that prices are high, and that the political situation in Mexico is gradually undergoing an alteration for the better. Already some of the long-interrupted copper smelters are at work again, and in the ordinary course of events it can only be a matter of a few weeks before a start should be made with getting the lead plants straight against the resumption of operations. When once Mexico begins to ship lead to Europe again the price of the metal will more nearly approach £15 a ton than £20 or more, which latter figure must prove harmful to consumption. Altogether there are vague indications that the extreme stringency of the market is by degrees becoming relaxed, though there may of course be temporary fits of fright on the part of over-sold parties, which may put up prices. It would be just as well, however, for consumers to begin to take a rather more cautious attitude in respect to the market at large, for values can hardly be expected to go much higher, while a very considerable drop must be expected when once the position in Mexico is clarified. In addition to this there is some idea that production is increasing in Spain, while the boom in silver is bound to tell sooner or later on the output of silver lead. The immediate position nevertheless is strong, and reports from Missouri indicate that the mines there are

not yet working properly, the withdrawal of the miners having caused them to fill with water, but pumping is going on vigorously, and in the course of a few weeks things there will have attained the normal, unless some fresh difficulty crops up. A feature in the market which is not at all liked, is the premium which near deliveries still command over distant. This has, undoubtedly, had a good deal to do with the reluctance of consumers to place contracts, for they are impressed with the suspicion that the position may be under manipulation. This idea is probably quite erroneous, but the mere fact that prices and output of lead are largely controlled by a convention, naturally leads to suspicions being entertained when outside conditions give colour to them.

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**The Forthcoming Gas Exhibition.**

Most of our readers are aware that the gas industry has been endeavouring for some time past to recover the ground lost owing to the introduction of the metal-filament lamp. Facilities for obtaining gas cooking and heating devices have been improved and the appliances themselves have been rendered more efficient. New forms of fittings and new types of mantles have been introduced and a vigorous publicity campaign has been entered upon, which, it must be admitted, is being conducted with considerable acumen and skill. Newspaper paragraphs and short articles have been inspired, attractive folders issued replete with telling and forceful arguments, and a system instituted of sending out advertising literature with every communication emanating from the offices of the gas companies. The effect of the campaign is bound to be felt shortly if it is not already sufficient to be appreciated, and it would appear that the electric supply authorities are either not fully aware of what is being done or that they are seriously underrating the efforts of their competitors.

During October a Gas Exhibition will be held in the Uxbridge Road Galleries of the "White City," which will present several novel features, which show how the industry as a whole is working for the benefit of everyone concerned. The plan usually followed in exhibitions has been abandoned, and in place of the customary rows of stands and stalls advertising the wares of competing firms, the town-gas lions will, so to speak, lie down with the producer-gas lambs and present an appearance of absolute harmony, which cannot fail to have an appreciable effect on the visiting public. In other words, the Exhibition is planned and will be laid out solely with the view of popularising gas, showing what gas can do in the home, the office, the shop and the factory; showing how it can light, warm and ventilate a house or a church; showing how it can cook anything, from an egg to an ox; how it can drive anything, from a sewing machine to a rolling mill. The safety of gas lighting and power will be demonstrated, its wonderful hygienic powers will be proved. It will probably be shown that it cannot dirty a ceiling or injure a growing plant; it may be shown that the headache so frequency experienced by those who live in gas-lighted and gas-heated rooms is really due to some sort of brain reaction caused by the intense enjoyment due to the adoption of that particular method of illuminating and warming the premises. At the time of writing it is not definitely known whether the advantages of gas lighting for express passenger trains will receive more than passing attention, but it is known that no efforts will be spared at this Exhibition to prove to the public that electricity is practically obsolete and that gas, used in any form or for any purpose, is immeasurably its superior.

It is an organised attempt to demonstrate to the public, including, of course, those who are now customers of the large electric undertakings, that for any purpose gas is not only suitable, but is the only thing suitable. We are not, however, fearful regarding its effect upon those who are already electrical consumers. In our last issue we gave particulars respecting an effort that *some* of the electric supply companies are making to provide a counter-blast in the shape of La Maison Electrique, at the Ideal Exhibition which opens at Olympia on October 8th. The Gas Exhibition will be backed by the full force of an industry with a capital running into very many millions of pounds; not so La Maison Electrique, for, as the reader has observed, financial support has not been generously given by electric supply authorities. Maybe some of them are not impressed with the past achievements of the Electric Supply Publicity Committee. There has, indeed, been good ground for criticism, but now that the Committee is trying to do something along attractive lines, we give it our ungrudging good wishes and urge it to cover up its past failings by utilising the Ideal Home opportunity to the full limit of its power. The electric supply manager, however, must not shut his eyes to the need for a strong commercial effort on the part of his own local organisation at such a time.

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**Monopoly Questions in Germany.**

The German Association of Special Electrical Works is unceasing in its endeavours to arouse public and Government interest in the monopolistic efforts of manufacturing companies in the direction of securing the control or ownership of central stations in different parts of the country, so as to obtain an additional permanent customer for electrical machinery, plant and materials. At the recent Leipzig meeting of the Manufacturers' Federation (Bund der Industriellen), Dr. Fasot, Syndic of the Vereinigung Elektrotechnischer Spezialfabriken, was successful in inducing the Federation to unanimously adopt a resolution addressing an urgent request to the Imperial Government and the Federal Governments to devote their attention to questions affecting the public supply of electricity, particularly the grant of concessions to private undertakers, the sale or leasing of communal electricity works, and the establishment of the so-called mixed economic enterprises or joint private and municipal undertakings. The resolution submitted that the availability of cheap electrical energy is of substantial importance in the interest of the competitive activity of German industries in the markets of the world, and that the industries must, therefore, demand that the public supply of electricity should be organised in the first place for the welfare of the general community and a private monopoly be prevented. It was also held that the consuming industries have a considerable interest in seeing that competition is not hindered either in the manufacturing or the installation branches of the electrical industry, and the Federation has consequently asked the Governments to adopt effective measures capable of meeting all endeavours put forth to obtain a direct or indirect monopoly of materials and installation work in connection with public electricity works. As has been previously mentioned in this journal, several of the Federal Governments have issued instructions at various times during the past two years, requesting the Government officials to take action in the direction indicated by the resolution in question. A fresh example has just occurred in Saxony, where the Ministry has published an order repeating the opinion that the public supply of electricity by the communes appears to correspond best to the public welfare as a rule, and the supervising authorities are therefore requested to forcibly support the supply of current by public bodies. In order to be able to do this successfully, the communes have been instructed to give immediate notice to the supervising authorities in every case where they enter into negotiations with a private undertaker in regard to the supply of their districts or the stoppage or sale of their works. The supervising authorities in their turn have to forward the notice to the Saxony Union of Municipal Works, and to the unions of public supply works in their respective districts, in order that the Unions may be able to cope with the threatened private competition. Federal Government orders of this, or a similar, kind, do not, however, prevent a continuance of the monopolistic efforts which, whilst being successful in some instances, meet with a check in others, as, for instance, quite recently at Offenbach and Carlsruhe, and also at Cassel, on September 18th. In the latter case, not only have private overtures been declined, but the Municipal Council has entered into an agreement with the Prussian Government (Weser River Administration) for the mutual supply of energy for a period of ten years.

## THE APHEGRAPHE: AN ELECTRICAL INSTRUMENT FOR USE IN GRAPHICAL MATHEMATICS.

The extreme delicacy and accuracy of "electric touch" as applied to measuring machines have already been dealt with in these columns* in connection with Dr. P. E. Shaw's precision measuring machine. The first application of this delicacy and accuracy to graphical mathematics is, we believe, to be found in the "aphegraphe"—an instrument designed by M. R. Guillery† primarily for the investigation of inertia forces in moving parts, but equally applicable to any procedure involving graphical differentiation.

Mathematical differentiation, of course, leads to perfectly accurate results, but not every engineer is familiar with the differential calculus. The mathematical expression of many motions which are simple, as regards the mechanism for

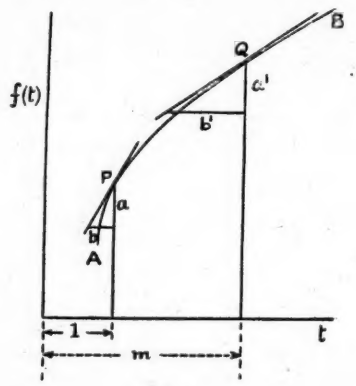


Fig. 1.

their production, is a difficult matter, and many cases arise in the testing of materials and in the investigation of machines and the motions of vehicles, &c., in which mathematical analysis becomes quite impracticable. In such cases, the differential coefficients of a function represented, say, by the curve A B, fig. 1, are determined graphically by measuring the slopes $a/b$, $a'/b'$, &c., of tangents at points P, Q, &c., in A B, and replotting the

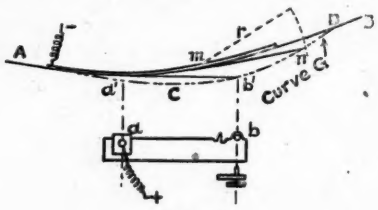


Fig. 2.

values of these slopes as ordinates against the corresponding abscissæ $l$, $m$, &c., to yield the first differential derivative of A B. The accuracy of the results obtained depends essentially on the exactitude with which the points of contact of the tangents can be determined. These points can be located with tolerable accuracy when the curvature of A B is great (as near P, fig. 1), but considerable errors can hardly be avoided where the radius of curvature of A B is great (as at Q, fig. 1). In any case, little reliance can be placed on the accuracy of, say, an acceleration curve obtained by successive graphical differentiation of curves of displacement and velocity. The *method* is not at fault; it is in its practical application that errors arise, and the object of the aphegraphe is to make possible the full realisation of the inherently universal applicability of graphical differentiation by making it possible to draw accurately the tangent to any point in the curve to be differentiated.

Referring to fig. 2, a glass base-plate carries a platinum tangent plate $a$, and a vertical spring needle $b$, centred accurately in the produced working plane of $a$. To use the instrument, the curve to be differentiated is first "materialised" by a rigid or flexible metallic template, the working face of which is vertical, and coincides at its lower edge with the curve investigated. The plate $a$ and the template are connected to the terminals of an electric bell circuit.

In using the aphegraphe, $a$ is brought successively into contact with various points on the materialised curve (contact being indicated by the ringing of the signal bell), and when each setting is complete, the needle $b$ is depressed. There are thus pricked out a series of points on a curve G, and when the latter is complete, a tangent can be drawn accurately to any point $m$ in A B by describing from this point as centre and with radius $r$ = distance between $a$, $b$ in the aphegraphe, a circular arc cutting G in $n$. The straight line $m\,n$ is then the desired tangent, and having obtained it, its slope and hence the differential coefficient of the function represented by A B at the point $m$ is determined in the usual manner. Experience shows that, using this instrument, second, and if required, third and fourth derived curves can be constructed rapidly, and with very small error. If curves possessing points of inflection have to be investigated, the platinum plate of the aphegraphe should be extended to working faces on both edges of the glass base.

* Electrical Review, July 25th, 1913, p. 127.

† "Bull. Technologique des Ecoles d'Arts et Métiers," Nos. 7 and 8, 1912.

## THE BRITISH ASSOCIATION.—II.

The only paper in Section G, on Friday, September 12th, of special interest to our readers, was the paper by Prof. J. T. Morris on the results of one year's working in domestic electric cooking and heating, in a flat having six rooms, kitchen and bathroom. The paper is one of very wide interest, and should prove valuable not only to central-station engineers, but to all householders desiring to get actual facts on this subject.

Saturday, September 13th, was entirely given up to sightseeing, not even Section A being at work. There was general satisfaction expressed at the excellent organisation of the various excursions to the places of interest around Birmingham. Certainly no part of the country is richer in historical associations, or more beautiful to look upon than some of the districts round the city.

On Monday there was a joint discussion between Sections A and G on "The Investigation of Complex Stress Distribution," in which Prof. Perry, Mr. W. A. Scobie, Mr. W. Mason, Mr. G. Cook, Prof. Petavel, Prof. Coker, Mr. J. J. Guest, Mr. J. S. Wilson, and Prof. S. Dixon took part; followed by a paper by Prof. E. G. Coker on "The Construction of Large Polarising Apparatus for Use in Lantern Projection Work." Afterwards a paper was read by Prof. A. T. Walmisley entitled "Metals for Structure."

The author said that fresh water corroded wrought-iron more rapidly than cast-iron, and malleable iron would rust more quickly in moist air, but would resist salt water better than cast-iron. Steel was more easily oxidised than wrought-iron, and far more easily than cast-iron. Generally speaking, though the oxidation of steel was faster than that of iron, it was more uniform, and the corrosion of both iron and steel was more rapid when partly wet and partly dry than when wholly immersed in water or wholly exposed to the air. He had found that nothing appeared to equal black varnish as a protection for iron or steel against corrosion in tidal waters.

To many of our readers the proceedings in Section B will have the chief interest. In that Section the utilisation of coal was investigated in an interesting series of discussions, initiated by Dr. Beilby, F.R.S., whose remarks will be abstracted in a later issue.

Dr. H. G. Colman came next with a description of the high-pressure gas supply in Birmingham for industrial purposes, the price being stated to be the lowest in England. It varies from 1s. to 1s. 4d. per 1,000 cb. ft., subject to 5 per cent. discount, according to the quantity used.

Mr. J. H. Yates (chairman of Messrs. John Wright and Co., Ltd.) gave an account of a new radiating gas fire, stated by him to be free from the worst objections with older types. The design is based on the use of fireclay tubes, in which there is said to be (when everything is properly regulated) perfect mixture and perfect combustion. As there is only one small bar in front, there is no obstruction to the radiant heat. No reflectors are required, the radiation being direct. It was pointed out that radiation is taking the place of convection in gas-fire design.

Mr. Yates described the radiometer used by Prof. Bone and Dr. Wm. Stroud, of Leeds, for measuring the efficiency of gas and other fires. He claimed now to reach the efficiency for heating rooms of 48 per cent. of the fuel value of the gas, as against 30 per cent. ten years ago. He said that gas fires should be designed of a wider form than hitherto, viz., 17 in. to 21 in. wide, the same width as a coal fire, and he pointed out the absolute necessity of having an air vent clear over the radiants for drawing away the air from the room along with the products of combustion, to secure good ventilation. For this purpose the canopy must be kept much higher than usual. He mentioned that there are no fewer than 350,000 gas fires in London to-day.

Mr. Yates admitted freely and, in our view, very properly, that a gas fire without a flue was a danger to health, and ought under no circumstances whatever to be permitted. The whole meeting (and it was a crowded one) showed its appreciation of this straightforward statement.

Prof. W. A. Bone, F.R.S., followed with a paper on "Gas Producers and the Use of Gas." He commented on the extremely low cost of the high-pressure commercial gas supplied in Birmingham, but remarked that while it was suitable for use in industrial operations on a comparatively small scale, it was still prohibitive in price for such purposes as, for instance, steel melting. It is still necessary for such purposes to use producers installed near the place of consumption.

As compared with 1s. to 1s. 4d. per 1,000 cb. ft. (less 5 per cent. discount) for the Birmingham supply of high-pressure gas, water gas from coke at 12s. per ton, and containing 290 B.TH.U. per cb. ft., could be produced for 4d. per 1,000 cb. ft. Comparing this with the Birmingham supply, it would be equivalent to coal gas at 8d. per 1,000 cb. ft. Thirty-five cb. ft. of water gas were obtained per lb. of carbon. Sixty per cent. of the total carbon appeared in the gas, and the overall efficiency in producing such gas was about 70 per cent.

Producer gas obtained when the fuel was completely gasified by air and steam blast could be produced with an overall efficiency of 75 per cent., and when ammonia was recovered as a by-product the cost per 1,000 cb. ft. of gas containing 145 B.TH.U. per cb. ft. from coal at 15s. per ton was only 1d. per 1,000 cb. ft., which was equivalent to coal gas at 4d. per 1,000 cb. ft.

The use of blast-furnace and coke-oven gas was increasing rapidly, and Prof. Bone said it was now clear that with the coke ovens, blast furnaces, and steel furnaces all on one site with the rolling mills, enough waste gas could be obtained to run the whole plant and even to supply some power outside. He estimated that blast-furnace gas from coke-fired furnaces averaged 168,000 cb. ft. of gas per ton of iron produced. From a furnace producing 1,000 tons of iron per week, there would be a yield of 1,000,000 cb. ft. of gas per hour.

The analysis was $CO_2$ 12 per cent., CO 30 per cent., nitrogen 58 per cent., and the heat value, say 100 B.TH.U. per cb. ft. at normal temperature and pressure.

After heating the Cowper stoves and producing the blast for the blast-furnace itself, there might be 40 per cent. of the total production of gas available for conversion into electrical energy for driving machinery.

The dust was one of the original difficulties, amounting to 5 grammes per cb. metre of gas. But cleaning arrangements had now been adopted which reduced the suspended dust to 0·01 gramme per cb. metre, which was clean enough for use in internal-combustion engines. The power absorbed in the cleaning process was about 5 per cent. of the original total. Therefore, there was available for actual power production, say, 38 per cent. of the gas. M. Hubert, of Seraing, had described at the recent meeting of the Iron and Steel Institute a single gas engine giving 6,500 H.P. on blast-furnace gas.

Dr. R. V. Wheeler next dealt with the composition of coal. In the destructive distillation of coal, he said there were produced two main classes of compounds—first, the paraffin-yielding constituents, which came originally from the resins; and, secondly, hydrogen and the oxides of carbon, which required a higher temperature to decompose them. These originated from the cellulose of the original vegetable growth. It had been found that pyridin had the power of solution of coal, increasing the paraffin-yielding compounds in the process. If the pyridin extract were now dissolved in chloroform one would get 80 per cent. of the volatile constituents. A more rational analysis of coals could be carried out on these lines.

Another promising development was the discovery that coal had an effect on a sensitised photographic plate if left close to it, but not quite touching it, in a dark room for 12 hours or so. The face of the coal must be made sufficiently flat to bring the whole surface fairly equally near to the plate.

The resinous constituents acted on the plate, so that when it was developed it showed by markings of white bands how such resinous constituents were stratified in bituminous coals. The pyrites came out white owing to yellow stains in the plate, while the residues that were insoluble in pyridin having no resin gave no effect. It was probable that coals with caking properties were caking coals chiefly because the resinous constituents were all mixed up with the other constituents instead of being stratified, as in the non-caking coals.

Dr. R. Lessing followed with a note on smokeless fuel and coal oil, and their relation to smoke abatement. He spoke of the probable adoption at no distant date of low-temperature carbonisation, with full recovery of the valuable fuel oils. He stated that in this country there were 210,000 tons of liquid fuel lost every year in the form of soot alone. Three millions of tons of fuel oil could be recovered from house coals alone in a year by low-temperature carbonisation, which would practically make Great Britain independent of outside supplies of fuel oil.

Mr. W. H. Patterson contributed a paper on "The Blending and Improvement of Coals," and stated that on treating small bituminous coal with chlorine, without changing its appearance or its weathering qualities, the coal was made to resemble anthracite in its qualities, and would give less ash and an increased evaporation of 25 per cent., no soot being formed. The meeting seemed a little sceptical about this figure.

A lively general discussion followed. Mr. Arnold Lupton said there was no need for alarm about the rate at which our coal supplies were going. The thing would correct itself, and when coal got dearer more efficient methods of utilisation would be adopted. He advocated a system of rewards instead of fines to abolish the smoke nuisance, and said that we could well afford them. He had computed that the actual loss caused by smoke in the atmosphere in Leeds amounted to a rate of 7s. in the £. He referred to the process of Berghaiser for the recovery of sulphate of ammonia.

Dr. Beilby said his experiments had no pretensions to be on a commercial scale. But he was satisfied that low-temperature carbonisation could be carried out on a large scale for 1s. per ton.

Prof. Armstrong remarked that any figure put forward by Dr. Beilby was sure to be reliable, and the only thing that he regretted about Prof. Bone's contribution was that he had made no reference to the very important work done by him on improved methods of combustion. Both he and other speakers emphasised very strongly the terrible danger which attended the use of any gas stove unprovided with a thoroughly efficient flue, and the necessity of accurate adjustment of all gas burner rings and other heating apparatus, so as to prevent the impingement of the hot flame on the cold heating surface. In fact, it became clear that for the safe working of such apparatus, precautions are necessary which are almost universally neglected at the present time.

For our own part, we regard the line of development as clear: improved combustion, or rather low-temperature distillation, of coal with recovery of fuel oils and ammonia, and utilisation of the gas in gas engines; subsequent

burning or gasification of rich coke for power production, the whole of the power being turned into electricity, which gives bright light and clear heat without burning up the oxygen of the room or risking the poisoning of its inhabitants.

This discussion was, in our opinion, of the highest value, and it would have been well worth the while of Section G to join it officially. As it was, large numbers that rightly belonged to Section G strayed into Section B to take part in it or to hear the speakers.

Amongst the works open for inspection was that of the General Electric Co., Ltd., at Witton, and during a tour of the busy shops a considerable amount of interesting work was observed. There were to be seen in course of erection in the engineering shop a number of large 1,000-KW. rotary converters, turbo-generators, haulage and rolling-mill motors, as well as several generators to be driven by blast-furnace gas engines, the low speed of which necessitates a generator of very large diameter. Two armatures observed in the course of winding had diameters of 3·3 and 3 metres, and commutators 2·6 and 2·4 metres in diameter respectively.

In the switchboard erecting shop a large number of high-tension and low-tension switchboards were observed, whilst the switchgear department was very busy with industrial switchgear in great variety to meet the urgent demand for gear complying with the Home Office regulations for the use of electricity in factories.

In the small motor shop in which Witton fans are constructed, from the small desk fan taking 20 watts, to the large 60-in. exhaust fans, a batch of centrifugal fans for one of the latest super-Dreadnoughts were in process of erection.

In the arc lamp department the Angold Magazine lamp, amongst others, was being assembled in very large quantities, and we were assured that, although this is not the time of year in which arc lamp orders are usually placed, over 80 per cent. of the orders for this lamp which have been received during the summer months have been repeats.

The foundry in which the company makes its own castings was also inspected, together with the stores, which act as a central point for the accumulation of a considerable proportion of the company's stocks.

At the conclusion of the visit to the works, the company's playing fields and dining club for the staff and workmen were inspected, and it was pleasing to observe the encouragement offered by the G.E. Co. to athletics and social gatherings.

The recent fire in the pattern stores has not been allowed to interfere seriously with the output, and a very complete organisation has permitted the prompt replacement of the patterns immediately required. The works are exceedingly busy, and have plenty of work ahead. They employ about 3,000 hands.

A circular issued at Birmingham gives details with regard to next year's meeting in Australia. There is also an invitation from the French Association for the Advancement of Science, to its meeting in Havre next autumn, which was mentioned last year, and which it is understood will be officially accepted, in order that those members who cannot go to Australia may avail themselves of French hospitality. It is understood that a circular with regard to the Havre meeting will be issued in due course.

The Australian meeting offers a splendid opportunity to those who can afford the time and money to visit that great country under the very best auspices. The hospitality offered is almost boundless. Enrolment of members for the meeting will take place after October 6th, but names can be sent in to the assistant secretary, at Burlington House, and will be attended to when the office reopens. New members desiring to join in the trip will only be enrolled after approval on written application to the Council.

Two advance parties, which will spend a week in Western Australia, will leave London by steamer on June 19th or 26th, or overland on June 25th or July 2nd, arriving at Perth, W.A., July 21st or 28th. On August 4th the advance parties proceed to Adelaide, together with the main party, which leaves London on July 8th or 9th by steamer, or overland to the Mediterranean.

A third party will go *viâ* New York, Vancouver and Sydney, and a fourth by Cape Town, the first-named leaving England about June 6th to 11th, and the second about June 22nd-24th. Adelaide, Melbourne, Sydney and Brisbane are the main centres to be visited, but extensive excursions will be made in all directions. Members can count on returning to England by about October 4th or 10th.

Members will receive vouchers entitling them to reduced fares, varying from first class £130, down to second class £65, according to the route chosen.

Particulars are also given of the route by the Siberian Railway.

On the arrival of the visitors in Australia, the State Railways will carry members free, which may be taken as a fair illustration of the generous welcome offered to the Association.

Future arrangements provide for the meeting to be held in Manchester in 1915, and in Newcastle-on-Tyne in 1916.

At an Honorary Degree Congregation of the University on September 11th, degrees were conferred upon Dr. Arrhenius, a pioneer in the theory of electrolytic dissociation and its bearing upon physical chemistry; Madame Curie, the discoverer of radium and "the greatest woman of science of all time"; and Prof. H. A. Lorentz, one of the foremost workers in mathematical physics, especially in connection with the electron theory.

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## The Nature of the Electromagnetic Waves Employed in Radio-Telegraphy, and the Mode of their Propagation.

By Prof. G. W. O. Howe, City and Guilds (Engineering) College, South Kensington. (*Section G. Abstract.*)

If power be transmitted by means of continuous current from one point to another, not, as is usual, by two parallel circular conductors, nor by a concentric cable, but by two wide strips of thin copper placed face to face and close together, both the magnetic and the electric fields will be approximately uniform throughout the space between the strips in any plane section normal to the direction of transmission. For this reason the consideration of such a transmission line proves an excellent method of approaching such conceptions as are involved in Poynting's theorem and electromagnetic wave phenomena. Although this method has its limitations, it will be seen to yield important results. After considering the continuous-current case, it will be shown that by using the same transmission line for alternate currents one is led to a clear conception of the nature of those gigantic electromagnetic waves which, emanating from a "wireless" aerial, spread over the earth in every direction. It will be shown that some of the fundamental ideas commonly accepted and taught in text-books on radio-telegraphy are fallacious.

Considering first the transmission of energy by means of continuous currents, let $i$ be the current in amperes and $e$ the P.D. in volts. If the resistance of the strips be neglected, the latter will be constant from end to end of the line. If $b$ is the width of the strips and $d$ the distance between them, the strength of the magnetic field between the strips is easily shown to be—

$$H = 4\pi/10 \cdot i/b.$$

If the strips are very close together H will be constant in the space between them and zero elsewhere. The same is true of the electric field, the strength of which is given by the formula—

$$E = e/d \text{ volts per centimetre.}$$

H and E are evidently at right angles and their product—

$$H E = 4\pi/10 \cdot ie/bd.$$

Now the power transmitted is $ie$ watts or joules per second, and this power is transmitted through the dielectric space between the strips and not through the strips themselves, which merely act as guides. The walls of a speaking tube act in very much the same way in guiding the energy which is transmitted as sound waves.

The energy transmitted across each square centimetre of dielectric cross-section will be—

$$ie/bd = H E \times 10/4\pi \text{ joules per second.}$$

Thus, at any point in space where there is simultaneously a magnetic field H and an electric field E at right angles, there is a transmission of energy in a direction at right angles to the plane of H and E, equal to $10/4\pi \cdot H E$ joules per second or watts, where E is expressed in volts per centimetre. This is Poynting's theorem. The relative directions of H, E and the transmission of energy can be seen from fig. 1 to be represented by the first and second fingers and the thumb respectively of the left hand, set mutually at right angles.

If the line is opened at the receiving end the current ceases and there is no magnetic field, but only the electric field. If the line is short-circuited the P.D. between the strips falls to zero and with it the electric field, leaving only the magnetic field. In neither case, however, is there any transmission of energy. For energy to be transmitted the electric and magnetic fields must exist simultaneously in the same space, and must be, to some extent, at right angles to each other. This is an important point often overlooked when considering the nature of the electromagnetic waves by which energy is radiated from an antenna; we shall return to it later.

The inductance of the line per centimetre of length—that is, the flux produced in the space between the conductors by unit current—is evidently $4\pi\, d/b$ absolute units, or $4\pi/10^9 \,.\, d/b$ henries.

The capacity between the strips per centimetre of length is $b/4\pi d$ absolute units, or $b/4\pi d \,.\, 1/(9 \times 10^{11})$ farads if the dielectric is air.

We shall now assume that the dynamo or battery is replaced by an alternator with a frequency of $\sim$ cycles per second, and that the

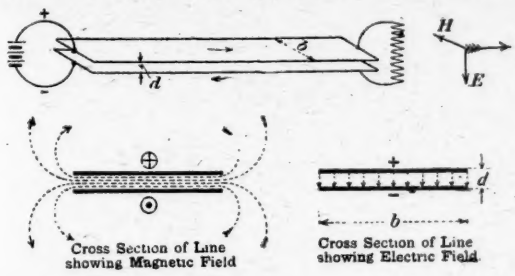



FIG. 1.

load at the far end of the long line is non-inductive. Every centimetre of the line has a certain inductance, L, and a certain capacity, K, the values of which we have just seen. The actual line could be replaced approximately by a number of inductances and condensers arranged as in fig. 2. The conductor resistance and the leakage are

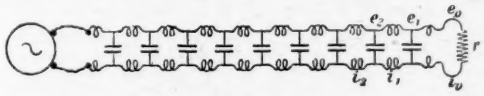


FIG. 2.

both assumed to be negligible. A vector diagram can now be built up by assuming a current through the non-inductive load and gradually working back along the line in the usual way. The vector diagram is greatly simplified, however, if the resistance $r$, constituting the load at the end of the line, is made equal to $\sqrt{L/K}$. (This ratio is a very important characteristic of the transmission line; it is sometimes called its surge impedance. By German writers it is called its "Wellenwiderstand"—*i.e.*, wave-resistance.)

If $r = \sqrt{L/K}$, the vectors of both current and voltage maintain a constant length—that is, an ammeter placed anywhere in the line will give the same reading, as will also a voltmeter connected between the lines at any point. In addition to this the two vectors will be in phase at every point. This can be readily seen from a consideration of fig. 3. If $i$ be the root-mean-square current at

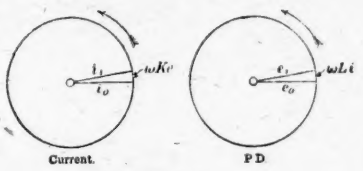



FIG. 3.

any point, the voltage drop per centimetre at that point will have a root-mean-square value of $\omega L i$ ($\omega = 2\pi \sim$), and will be 90° out of phase with the current. If $e$ be the P.D. between the lines at any point, the capacity current per centimetre at that point will have a R.M.S. value of $\omega K e$, and will be 90° out of phase with $e$. For the current and voltage vectors to maintain a constant length and rotate together it is obviously necessary that $\omega K e/i = \omega L i/e$.

Since $e/i = r$, this is equivalent to $r = \sqrt{L/K}$. With a load of this value the energy is absorbed as fast as it arrives, and there is no reflection back along the line to cause stationary waves. The result is just the same whether the line is short or long. At those points along the line where the current, and therefore the value

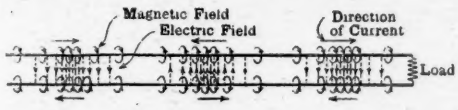



FIG. 4.

of H, is a maximum at any moment the P.D., and therefore also the value of E, will be a maximum at the same moment (fig. 4). The rate of energy transmission in watts per square centimetre is given at every point, at every moment, by the formula $10/4\pi \,.\, H\,E$.

If the non-inductive load be replaced by a choking coil of negligible resistance, or by a condenser with negligible losses, the voltage and current vectors will be 90° out of phase, not only at the end but all along the line. This is easily proved, because the voltage drop is at right angles to the current vector and the capacity current is at right angles to the voltage vector at every point. The current in the line at any moment is a maximum when the P.D. is zero, and *vice versa*, so that we have alternately a storage of magnetic energy and a storage of electrical energy, but no resultant transmission of energy. In this case we have stationary waves on the line.

Returning now to the case of the non-inductive load, the velocity of the wave along the line is easily found from fig. 3. The inductive drop per centimetre is $\omega L i$; for a length $l$ the drop is $\omega L i l$, and this is set off around the circumference of the circle described by the vector $e$. If we take such a length along the line that $\omega L i l = 2\pi e$, we arrive at a point where the phase is the same as at the end; this value of $l$ is therefore the wave-length $\lambda$.

Hence, $\lambda = 2\pi e/\omega L i = 2\pi/\omega\sqrt{K\,L} = 1/(\sim \sqrt{K\,L})$,

and the velocity of the wave

$$= \lambda \,.\, \sim = 1/\sqrt{K\,L}.$$

Substituting the values of K and L, we have—

$$\frac{1}{\sqrt{b/4\pi d \,.\, 4\pi d/b \,.\, 1/(9 \times 10^{20})}} = 3 \times 10^{10} \text{ cm. per second.}$$

Hence, the electromagnetic wave travels along the line with the velocity of light.

We have seen that the ratio $e/i$ is constant all along the line and equal to $\sqrt{L/K}$; therefore, $L\, i^2/2 = K\, e^2/2$, that is, the total energy in each cubic centimetre of the dielectric space is at every moment equally divided between the magnetic and the electric fields. The total energy in 1 cm. of the line is $K\, e^2{}_{in.}$, where $e_{in}$ is the instantaneous value of the P.D., and the average value of the energy per centimetre is $K\, e^2$, where $e$ is the R.M.S. value of the P.D. This energy is being transferred with the velocity $v = 1/\sqrt{K\,L}$, and the amount of energy arriving at the far end in a second will be—

$$K\, e^2 \times 1/\sqrt{K\,L} = e^2 \times \sqrt{K/L} = e^2/R \text{ joules.}$$

The electromagnetic waves in the space between the two strips are of the simplest possible type, viz., plane waves. If the two strips are made several hundred miles wide and several hundred feet apart, and if the lower strip is replaced by the earth, no essential change is made in the nature of the waves; it is simply a matter of scale. We should then have sweeping over the surface of the earth plane electromagnetic waves. In many problems connected with radio-telegraphy it has been assumed for the sake of simplicity that the waves employed are of this type.* It may be objected that, in the case of radio-telegraphy, we have not a transmission free from loss with a non-inductive load of a certain definite value at the far end. In the theory of the propagation of telephone currents it is a well-known and easily proved fact that for a long line in which the energy is dissipated before it arrives at the far end, where it might otherwise be reflected, the apparent impedance of the line is equal to $\sqrt{Z/Y}$, where $Z = R + j\,\omega\, L$ is the impedance of unit length of the line and $Y = G + j\,\omega\, K$ is the admittance of unit length (G is the reciprocal of the insulation resistance, $j = \sqrt{-1}$ and $\omega = 2\pi \sim$). If R and G are small compared with $\omega$ L and $\omega$ K, the apparent impedance of the line will be simply $\sqrt{L/K}$, and the current at the sending end will be in phase with the applied P.D. so that the line appears to be non-inductive. This will also be true if $R/L = G/K$, which is the condition for Oliver Heaviside's distortionless transmission line. In the case of radio-telegraphy the damping is small, especially over the sea, and we make little error in assuming that the current and P.D., or, as we must say if we refer to the space between the conductors and not to the conductors themselves, the magnetic and electric fields are in phase.

We can, however, approach much more closely to the actual radio-telegraphic waves by assuming that the two parallel strip conductors radiate from the alternator in all directions. The upper strip now becomes an upper disk and the lower strip a lower disk, or merely the earth, while the alternator is imagined to be connected between the centres of the disks. All round the edges of the disks, which we imagine to be of enormous diameter, we can assume a non-inductive load of the correct value to be uniformly distributed, or, more in accordance with facts, the resistance of the lower disk (the earth) may be assumed to dissipate the radiated energy so that none ever reaches the limits of the disks. The transmission will, however, be no longer perfectly distortionless, unless we assume that the leakage bears the necessary relation to the resistance, but this is a point of minor importance.

The magnetic flux will be distributed concentrically around the generator in alternate belts in opposite directions, there being no flux except between the disks. Passing outwards from the centre of the disk one would pass through successive belts of current flowing alternately radially outwards and radially inwards. At every point in either disk there is an alternating radial current.

The radiation of energy is in this case strictly cylindrical, but is otherwise identical with the radiation from a "wireless" antenna. The electric and magnetic fields in the neighbourhood of the lower disk are identical in their nature with those near the earth, but the variation with the distance from the generator is different.

This want of agreement is entirely removed by making the height of the upper disk above the lower vary directly as the distance from the centre, or, in other words, by replacing the upper disk by an inverted cone, as shown in fig. 5. The alternator is connected between the apex of the cone and the point of the earth

* Zenneck, *Annalen der Physik*, 1907, Vol. XXIII, p. 846.

almost in contact with it. This supposititious arrangement not only gives a radiation of electromagnetic waves almost identical with that of wireless telegraphy, but at the same time lends itself to very simple calculation. Contrary to the case of the two parallel disks, the inductance per radial centimetre of this new

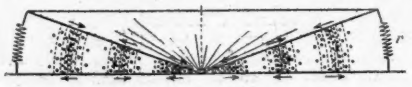


FIG. 5.

multi-directional transmission line is constant—*i.e.*, independent of the distance from the origin—as is also the capacity per centimetre. In this respect the inverted cone arrangement is similar to the ordinary telephone line or the two flat strips already considered, and leads to the same simple formulæ and the same vector diagrams.

To calculate the inductance per radial centimetre we have to find the flux per radial centimetre when unit current flows steadily outwards in the cone and returns radially to the centre of the lower

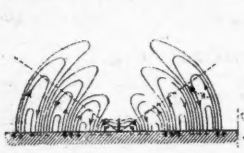


FIG. 6

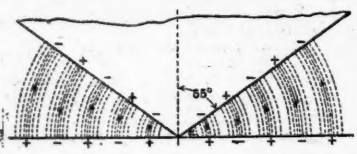



FIG. 7

disk. Let $\alpha$ be the angle between the cone and the lower disk, $x$ the distance from the centre and $d$ the distance between the cone and the earth, measured along the circular arc, then $d = \alpha x$. The length of the magnetic path is $2\pi x$, and the flux per radial centimetre for unit current is $4\pi d/2\pi x = 2\alpha$, and the inductance per centimetre is, therefore, $2\alpha \cdot 10^{-9}$ henry. The capacity per radial centimetre is obviously that of a plate condenser with plates of area $2\pi x$, separated a distance $d$, which is $2\pi x/4\pi d = 1/2\alpha$ absolute units, or $1/(2\alpha \times 900{,}000)$ mfd.

Hence, apart from damping, the current and the P.D. will vary from point to point exactly as in an ordinary telephone line with these values of inductance and capacity per unit length. The strength of the electric field E at any point is found by dividing the P.D. at the point by the distance between the cone and earth, which varies as the distance from the generator. Now we have already proved that, apart from damping, the P.D. has the same amplitude all along the line, hence the strength of the electric field E will vary inversely as the distance from the centre. Again, since the length of the magnetic path varies directly as the distance from the centre, the magnetic field strength H must vary inversely as the distance. This agrees with the results obtained for the radiation of electromagnetic waves from a Hertzian oscillator or antenna. It is seen, therefore, that, taking the earth as the lower disk and replacing the upper atmosphere by the perfectly conducting inverted cone, a system of electromagnetic waves is generated and propagated, and these waves are identical in their nature and properties—at least, in the neighbourhood of the earth—with those electromagnetic waves employed in radio-telegraphy, and vary in intensity from point to point on the earth's surface in exactly the same way. This radiation cannot be called cylindrical, but is essentially spherical, the wave fronts being approximately portions of spheres.

Although this supposititious arrangement gives the correct values of E and H near the surface of the earth, this cannot be so for the upper atmosphere, where, instead of ending normally on an upper conical surface, the electric field forms loops as shown in fig. 6.

### CALCULATION OF THE ANGLE $\alpha$ BETWEEN THE CONICAL SURFACE AND THE EARTH.

If one is merely considering the question from a qualitative point of view, the slope of the upper conical surface is immaterial. To make quantitative calculations, however, the angle must be so chosen that the total amount of energy in the advancing wave bears the same relation to the values of H and E near the earth's surface as it does in the actual radio-telegraphic wave. The correct value of this angle is easily calculated. On the assumption of a perfectly conducting flat earth, the strength of the electric and magnetic fields at the earth's surface due to a vertical aerial is given by the following equation*—

$$E = H = 2\, i_{max.}/10 \cdot \frac{\cos(\omega t - \omega x/v)}{x}.$$

where $i_{max.}$ is the maximum aerial current in amperes, $\omega = 2\pi \sim$, $x$ = distance from aerial in centimetres, and $v$ = velocity of light in centimetres per second.

Therefore, $E_{max.} = H_{max.} = i_{max.}/5\, x$ C.G.S. units, or, $E_{max.} = i_{max.}/5\, x \times 300 = 60\, i_{max.}/x$ volts per centimetre. Again, the total power radiated from a vertical aerial is $0{\cdot}61\ I^2/v$ ergs per second,† where I is the amplitude of the antenna current in electrostatic units. Putting the current in amperes and $v = 3 \times 10^{10}$, we have—

$$\frac{0{\cdot}61 \times i^2_{max.} \times 9 \times 10^{18}}{3 \times 10^{10}} \text{ ergs per second}$$
$$= 18{\cdot}3\ i^2_{max.} \text{ watts},$$
$$= 36{\cdot}6\ i^2_{R.M.S.} \text{ watts}.$$

* Abraham, "Theorie der Elektricität," Vol. II, p. 300.
† Abraham, *loc. cit.*, p. 304.

Now in the supposititious case of the inverted cone and the perfectly conducting lower disk, the amplitude of the total radial alternating current is the same at all distances from the centre, and the length of the magnetic path is $2\pi x$. The strength of the magnetic field at a distance $x$ will therefore be—

$$H_{max.} = \frac{4\pi/10 \cdot i_{max.}}{2\pi x} = i_{max.}/5\, x,$$

and the electric field

$$E = \text{P.D.}/d = \frac{i\sqrt{L/K}}{\alpha x} = \frac{i}{\alpha x}\sqrt{\frac{2\alpha \cdot 10^{-9}}{1/2\alpha \cdot 1/(9 \times 10^{11})}}$$
$$= i/\alpha x \cdot \sqrt{3{,}600\,\alpha^2}$$

and $E_{max.} = 60/x \cdot i_{max.}$ volts per centimetre. (Note.—$H_{max.} = E_{max}$ if the latter is expressed in electrostatic units.)

Now the apparent resistance of our transmission line is $\sqrt{L/K}$, and the power supplied to it by the alternator, and, therefore, transmitted along it is $i^2_{R.M.S.} \sqrt{L/K} = i^2_{R.M.S.} \times 60\alpha$ watts. In the case of the actual aerial the power radiated is $36{\cdot}6\ i^2_{R.M.S.}$ watts. Hence, for the radiated power to be the same in each case, we must have

$$60\alpha = 36{\cdot}6, \text{ or } \alpha = 0{\cdot}61 = 35°.$$

This angle can be found in another way without considering the apparent resistance of the transmission line. We have seen that by Poynting's theorem the power transmitted across a square centimetre is equal to $10/4\pi \cdot HE$ watts. The maximum power per square centimetre will, therefore, be $10/4\pi \cdot i_{max.}/5x \cdot 60\, i_{max.}/x = 30\, i^2_{max.}/\pi x^2$ watts, and this will be the radiation at any point at the moment when H and E have their maximum values at that point. Since both H and E vary according to a sine law, the average rate at which energy is transmitted across each square centimetre is equal to half the maximum, viz., $30\, i^2_{R.M.S.}/\pi x^2$ watts. The total radiation is

$$30\, i^2_{R.M.S.}/\pi x^2 \times 2\pi x \times \alpha x = i^2_{R.M.S.} \times 60\alpha \text{ watts},$$

as found by the other method.

Hence, if the arrangement of inverted cone and lower disk is to give a correct representation of the actual radio-telegraphic waves, as regards both H and E and the total radiated energy, the angle $\alpha$ cannot be such a small angle as in fig 5, but must be exactly 35°, as shown in fig. 7.

It will be evident from the foregoing, and especially from fig. 4, that the vertical electric field is a maximum at any point at the same moment that the magnetic field at the same point is a maximum. The writer has found that there is a prevalent idea

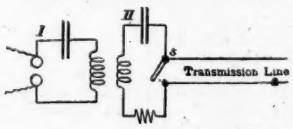



FIG. 8.

that the successive bands of vertical electric flux sweeping out from the antenna with the velocity of light *alternate* with bands of magnetic flux. This is not so; the electric and magnetic fields occupy the same space at the same moment, and the successive bands are separated by spaces in which both H and E fall simultaneously to zero. This is only true, however, if we avoid the immediate neighbourhood of the antenna. The current in the antenna, and therefore its magnetic field, are zero at the moment when the P.D., and therefore also the electric field, are approximately at a maximum. It is important to notice, however, that if the current and P.D. were exactly 90° out of phase, the antenna oscillation would be wattless, and there could be no radiation of energy. The radiation has a similar effect to the introduction of an additional resistance in the antenna, and constitutes the useful load on whatever may be used to maintain the oscillation. In the immediate neighbourhood of the aerial there are powerful magnetic and electric fields, which are nearly 90° out of phase, and which produce, for the most part, an oscillation, as distinct from a transmission of energy. It is only the components of H and E that are in phase which can cause a transmission of energy, and the other components are negligible beyond a certain distance from the antenna.

If there were no radiation the antenna could be represented by an equivalent inductance, capacity and resistance forming a closed oscillatory circuit, as in fig. 8, where I is the spark-gap circuit and II the equivalent aerial circuit. In fig. 8 a new cause of damping can be introduced into circuit II by opening the switch $s$, viz., a transmission line, which, if infinitely long and free from losses, acts exactly as an additional non-inductive resistance in the circuit. Here it is evident that a part of the oscillating energy is now transmitted away along the line and that in this line current and P.D. are in phase.

The same is true in a sound wave. Our sending antenna is here replaced by an organ pipe in which we have stationary waves, with a stationary distribution of pressure at one moment, succeeded after a quarter of a cycle by an equal pressure distribution of velocity. The maximum velocity occurs at points a quarter of a wave-length away from the points of maximum pressure. When sound waves travel through space, however, the conditions are very different; the compressional waves are in phase with the velocity waves, that is to say, the air particles which have the maximum compression or maximum rarefaction at a given moment are those which are moving with the greatest velocity (*see* Poynting and Thomson's "Sound," p. 13).

As we have already said, there is a prevalent idea that the electric and magnetic fields succeed one another alternately; the fourth chapter of Prof. Fleming's "Elementary Manual of Radio-telegraphy," which is devoted to a study of electromagnetic waves, is permeated through and through with this fallacy, which is even supported by mathematical treatment by giving incorrect solutions for the differential equations.

[NOTE.—The statements here criticised occur in the first edition of the "Elementary Manual." On the receipt of an advance proof of the paper, Prof. Fleming wrote to the author pointing out that the error had been discovered and corrected in a second edition published three years ago. The author must therefore apologise to Prof. Fleming for having done him the obvious injustice of criticising statements which he himself had already corrected. Had the author known of this later edition, this part of the paper would have been very much modified.]

Returning now to the electromagnetic waves travelling over the earth's surface, we have seen that the calculated strength of the electric field near the surface is $60\,i/x$ volts per cm., where $i$ is the current in the sending antenna. This field is normal to the surface—*i.e.*, it is a vertical field. These results are confirmed by experiment if the distance from the sending antenna is not too great. The distance at which marked discrepancies appear depends on the wave-length employed, and especially on the nature of the earth's surface. These discrepancies are to be expected because we have made three assumptions:—

1. That the earth is a perfect conductor, whereas dry soil might be better described as a poor insulator.
2. That the earth is flat.
3. That the atmosphere is a perfect and uniform dielectric at all heights.

A large amount of mathematical work has been devoted to the effect of the resistance and specific inductive capacity of the earth's crust, and also to the effect of curvature. The nature and effect of the upper layers of our atmosphere is the subject of a great deal of speculation at the present time, but all these questions call for systematic research on a large scale. Their discussion would go beyond the scope of this paper.

## Exposure Tests of Copper, Commercial Aluminium, and Duralumin.

By ERNEST WILSON.

(*Section G. Abstract.*)

THESE are a continuation of tests upon the influence of exposure in London on the electrical conductivity of light aluminium alloys, reports of which have been made from time to time to the British Association. Each specimen is in the form of wire 0·126 in. diameter and 70 ft. long; and the figures obtained after two years' exposure are:—

| | Percentage increase of electrical resistance taken on value in 1911 at 15° C. |
|---|---|
| High conductivity copper ... ... ... | 2·0 |
| Commercial aluminium ... ... ... ... | 4·4 |
| Duralumin ... ... ... ... ... | 8·2 |

Duralumin is a copper-manganese-magnesium alloy of high tensile strength, and exposure has apparently made it more brittle.

## Practical Standards for Use in Electrical Measurements.

*Report of the Committee:* LORD RAYLEIGH (*Chairman*), DR. R. T. GLAZEBROOK (*Secretary*).

(*Section A. Abstract.*)

THE republication of the Reports of the Committee from 1862 to 1870, and from 1881 to 1912, is now complete. The volume consists of about 800 pages, with several plates, and is published by the Cambridge University Press on behalf of the Association.

In 1861 the first work to be undertaken by the Committee was the realisation of the absolute unit of resistance. In 1882, 1883, 1888, 1894, and again in 1897, other measurements were made by members of the Committee, and in this their last Report they are pleased to be able to announce a further development. The new Lorenz apparatus at the National Physical Laboratory is now complete, and measurements of resistance can be made by means of it with an uncertainty of not more than a few parts in 100,000. During the present year a large number of such measurements have been made, and the results obtained are now being prepared for publication.

A satisfactory feature of the machine is that it can be used at all times for absolute measurements, and the plans adopted for the redetermination of the dimensions of the coils ensure an accuracy in the future as great as that obtained in the recent measurements. The nominal values of the resistances measured are 0·001, 0·002 and 0·01 ohm. As an instance of the care taken, it may be mentioned that the dimensions of the coils have been measured with a current flowing through them, and the radius of a disk 53 cm. in diameter has been determined within 0·01 mm. when running at 1,200 R.P.M. Electrical methods of setting the coils parallel and coaxial with the shaft proved to be more sensitive than the usual methods, and a Wheatstone bridge with a condenser in one arm proved to be the most sensitive indicator of constancy of speed. This instrument, together with the Ayrton-Jones current balance, enables the fundamental electrical units to be realised with an accuracy sufficient for all present purposes. It is hoped to rewind the coils of the current balance and leave them uncovered with paraffin wax so that their dimensions may be determined at any time.

The Committee are pleased to report that the original rotating-coil apparatus, designed by Lord Kelvin in 1861, is in good condition, and steps are being taken for its inclusion in the science collection of the Victoria and Albert Museum, South Kensington. Some rough measurements of resistance were made by the apparatus in the spring of this year, and the coils used by Lord Rayleigh in 1882 were also experimented with. An account of the apparatus is given in the Secretary's "Kelvin" Lecture to the Institution of Electrical Engineers.

A statement on international comparisons of resistances and standard cells was included in last year's Report and sufficiently indicates the arrangements that have been made for the maintenance of constant electrical standards in the future. The Committee regard these arrangements as satisfactory. They do not ask for reappointment.

## On the Minimum Quantity of Light Discoverable by means of Selenium.

By E. E. FOURNIER D'ALBE, D.Sc

(*Section A. Abstract.*)

THE paper dealt with the behaviour of selenium under very faint illuminations. The changes in conductivity resemble phenomena of ionisation and recombination, inasmuch as the light-action curve satisfies the equation $dK/dt = I - C K^3$, where $I$ is the illumination, $C$ the coefficient of recovery on recombination, and $K$ the additional conductivity imparted to selenium by the action of light. The initial light-action is a linear function of the time, so that the action observable in a given time is proportional to the "exposure" if the latter is short. The final additional conductivity is proportional to the square root of the illumination. This offers a means of discovering very faint illuminations. A current of the order of $10^{-9}$ ampere is obtainable by the unaided illumination produced by Venus, and it should be possible to discover invisible stars by means of a sensitive galvanometer without any optical aid. Attempts to do this were described, and the bearing of the results on the theory of quanta was discussed.

(Some new applications of the properties of selenium were demonstrated at the University Buildings.)

# NEW ELECTRICAL DEVICES, FITTINGS AND PLANT.

## The "Kemco" Fan Electric Lighting Dynamo for Motor-Cars.

Among the many small dynamos for motor-car electric-lighting purposes recently introduced in America, probably the most novel is that known as the "Kemco," lately put on the market by the KOUYOUNIJIAN ELECTRIC AND MANUFACTURING CO., of Cleveland, O., U.S.A. One of the difficulties in connection with the problem, especially in the case of old cars is that of finding a convenient location for the dynamo, so that it can be easily driven. It has remained for the Kouyounijian Co. to discover the fact that a generator could be built up as the hub of the fan which now forms a standard part of the engine-cooling system; by this means not only is no more additional space about the engine taken up, but an additional drive is unnecessary, the belt that operates the

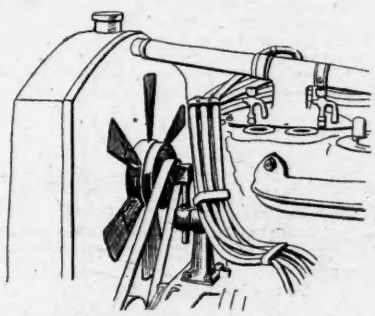


FIG. 1.—THE "KEMCO" COMBINED RADIATOR FAN AND DYNAMO.

fan, also driving the electric generator. As the illustration (fig. 1) shows, excepting that the fan has a somewhat larger hub than usual, the combined fan and dynamo outwardly differs but little from the usual fan, while it is claimed that as the inner end of the fan blades is of little use, the reduction of the fan blade area by the enlarged hub—which forms the casing of the generator—represents practically no loss of efficiency so far as the fan draught is concerned.

Constructionally, the dynamo differs from standard practice in that the field remains fixed in the centre while the armature

rotates round it, this arrangement being claimed to result not only in better cooling, but the more certain retention of the windings owing to the centrifugal force tending to force the windings into instead of out of their slots. A battery of accumulators is, as usual, employed in connection with the generator, the latter being arranged so as to charge the same at all engine speeds between 400 and 1,200 R.P.M. The regulation of the machine is automatically accomplished by magnetic leakage gaps incorporated within it. An ammeter mounted on the dashboard of the car forms part of the equipment; in the same base as the ammeter is a cut-out, to which the main wiring from the dynamo is connected. Two head lights, two side lamps, a tail lamp and a dashboard lamp are installed.

One special advantage of driving both dynamo and fan by one belt is that the ammeter affords the driver a ready indication as to the operation of the belt, a slipping belt, and the consequent imperfect cooling action of the fan on the radiator, being immediately indicated by the needle of the ammeter.

### Dowsing Heating and Cooking Apparatus.

The Dowsing Radiant Heat Co., Ltd., of 105, Great Portland Street, London, W., have issued a new season's list of the above apparatus, in which department of the industry, by reason of their very lengthy experience, they are, of course, in the front rank of specialists. In the course of the seventy and more pages they illustrate and give prices and brief particulars of the Dowsing

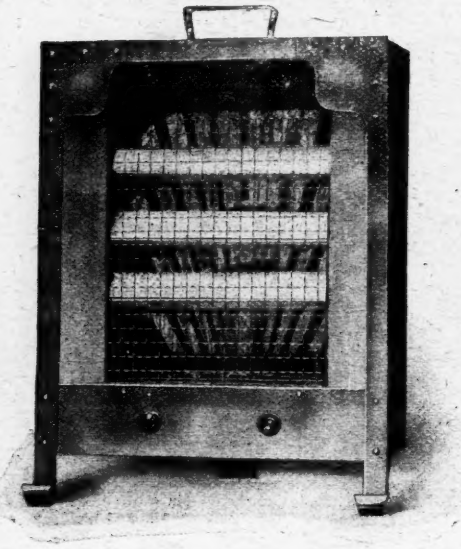


Fig. 2.—Dowsing Hot Bar Radiator.

luminous radiators, the Dowsing-Huntley convectors, radio-convectors and hot-bar radiators, also the Bastian red-glow radiators, as well as a variety of cooking apparatus. In the luminous radiator pages there are a number of new designs. Attention may be directed to the firm's new hot-bar radiators, which are made in various designs. These are fitted with a special form of reflector giving a ruby illumination, having the appearance of a glowing coal fire. This reflector also acts as baffle plate and flue,

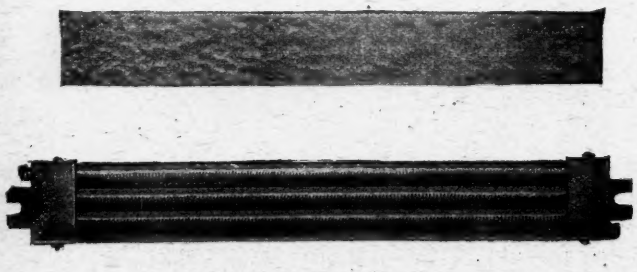


Fig. 3.—Dowsing Hot Bar.

which projects the current of heated air into the apartment. The hot-bars themselves (see fig. 3) are stated to be very durable, strongly constructed and easily replaceable. The whole of the radiator is so arranged that by the turning on of a button the radiator can be opened for cleaning or renewing the elements. These hot-bar radiators (fig. 2) are made by the firm with or without quartz coverings. When the quartz cover is used a considerable amount of protection is afforded and water spilled on the heating surface has no effect. The elements are made to take 500 watts, and to run in parallel so that each element may be switched on or off to reduce the heat produced in the radiator at will. The heating element can easily be replaced and the heat resistance wires can be refitted at a very small cost. With the Dowsing-Huntley patent system of double back, a large volume of air is heated and passed through the radiator per hour. Each radiator has accessible terminals, and is made with a movable back for easy inspection, &c.

A typical example of the firm's electric kettles is shown in fig. 4. These kettles are of new and improved designs, and fitted with special heating elements. The combined toaster grill and hot

Fig. 4.—A Dowsing Kettle.

plate in fig. 5 is also fitted with the new hot bars. The Dowsing Co. have had considerable experience with these electric grillers at their Medical Institution in London, where they cook by electricity for more than 60 persons daily. With grilling it has been found that there is a danger to the elements by the meat being sometimes forced against them, or by the chef's fork causing a short-circuit. These points have received special attention in the Dowsing grillers.

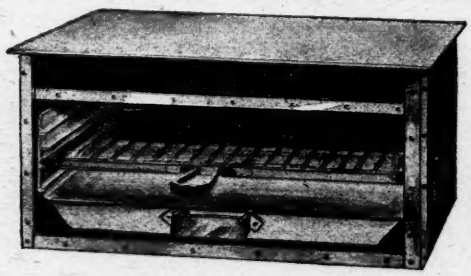


Fig. 5.—Combined Toaster, Grill and Hot Plate.

From among other articles listed, we may single out for mention a breakfast toaster and dish warmer combined. This has a hot plate on which plates and dishes may be kept warm, and the lower portion is fitted with two toast racks to allow toast to be made on the table.

### B.T.H. Automobile Switches.

The British Thomson-Houston Co., Ltd., of Mazda House, Upper Thames Street, E.C., have placed on the market a series of automobile switches of neat design and lasting construction, which are made in two types, for surface and flush fixing respectively, and in two finishes, polished brass and nickel. The switch is of the

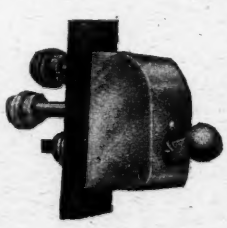


Fig. 6.—Surface Type. Fig. 7.—Flush Type.

single-pole type, but two, three or four switches can be mounted side by side on one plate, so that any desired switching combination can be arranged. Surface type B.T.H. automobile switches (fig. 6) have the ordinary tumbler movement, while the flush switches (fig. 7) can be had either with tumbler or push-button movement. There is also a flush locking switch which is operated by means of a key.

### The Flarion Lamp.

Messrs. Scholey & Co., Ltd., of 151, Queen Victoria Street, London, E.C., claim for the Flarion arc lamp, which they have put upon the market, extreme simplicity of design and strength of construction. It is made at present in two sizes—10 and 18-hour—and is equally well adapted for alternating and direct current.

In this lamp (fig. 8) the vertical plunger solenoid cores are provided with extensions which, while allowing comparatively free movement, give sufficient natural air-cushion effect to eliminate all hammering and pumping.

The feed mechanism consists of a simple three-wheel train steadied by a rotary air fan and ending in a substantial chain drum, from which is suspended the weighted carbon carrier. The high-

speed wheel consists of a smooth edge brake-wheel released or held by a clutch operated directly from the rocking arm. No escapement bars, toothed clutches, or ratchets are used, and by this means another very prolific source of breakdown is removed. The brake is positive and exceedingly delicate, so much so that it is no uncommon thing for the carbons to feed with half a revolution of the brake wheel, while a two-volt arc regulation can be assured. One strong centre chain supports the carbon carriers, and this is raised when trimming, by a button neatly housed and running in a slot in one of the outer frame rods. The striking gear is supported well above the furnace, and the carbon guides consist of metal straps clamping mica plates, thus doing away with the possibility of cracked insulating pieces. The blow-magnet is particularly well designed, and together with the economiser has received special attention. Experience has shown that without a

Fig. 8.—The Flarion Lamp.

properly-constructed arc chamber or economiser, and a well fanned-out arc, the carbons will burn unevenly and consume too fast, sometimes giving only 7 hours' life out of 10-hour carbons.

In the Flarion lamp all brass parts are heavily plated to withstand fume action, and the cases are scientifically ventilated and trebly enamelled.

Adjustment of the electro-magnetic control is made by means of a set weight on the rocking arm; it is entirely free from springs or any other form of variable tension adjustment which sooner or later is sure to land an arc lamp user in difficulties.

### The "Eye" Electric Motor Lamp.

An extremely interesting form of electric motor-car lamp has recently been brought out in France. It is known as the "Eye" orbicular lantern, and is the design of M. Cannevel, of 14, Rue

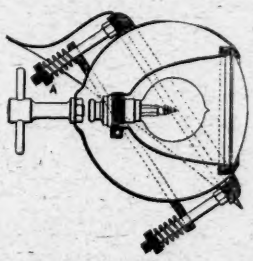


Fig. 9.—The "Eye" Electric Motor Lamp Section.

Reval, Levallois-Perret, near Paris. The lamp is of the type designed to be embodied in the bodywork of the car, the feature being that it can, at the will of the driver, be turned in any direction, the socket being so arranged that it can be swept over an arc of 80° from left to right, and up and down. The lamp is held in any position by two small clamps, which are removable from the inside, and can be adjusted instantaneously, so as to illuminate sign-posts at the side of the road, mile-stones, and even the motor in front. The entire lamp can also be pulled right out of the socket and used to light the underside of the dashboard under the footboard, and as a general "trouble lamp." A slight loosening of the milled nuts A (fig. 9) permits of turning the eyeball by means of the handle in any desired direction.

### Willans Rotary Air-Pumps.

Messrs. Willans & Robinson, Ltd., of Victoria Works, Rugby, have undertaken the manufacture of the Müller-Josse patent rotary air pumps, which are in extended use on the Continent,

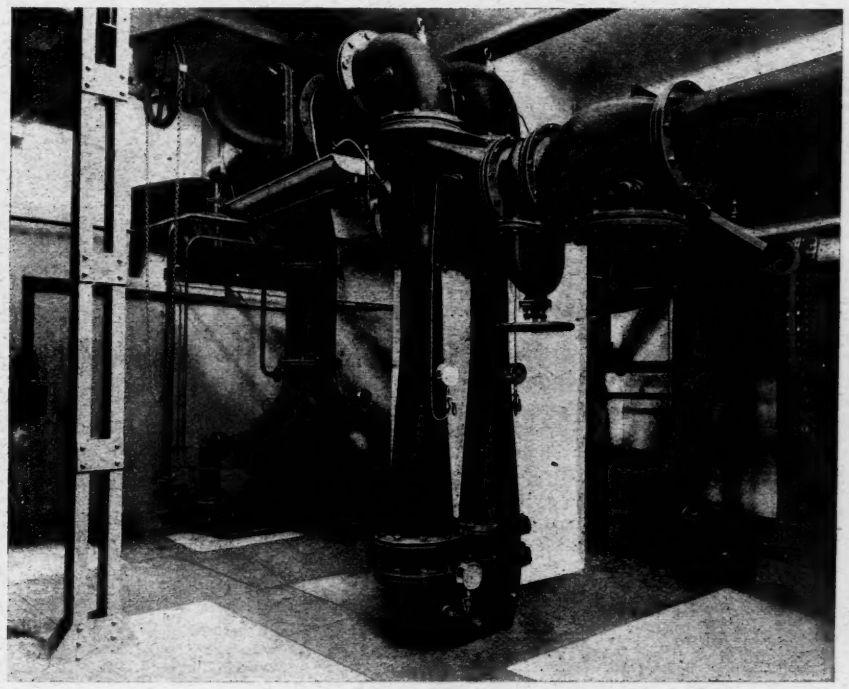


Fig. 10.—Willans 4,000-kw. Surface Condensing Plant.

and they have already secured orders for a plant of 8,500 kw. for the Sheffield Corporation, as well as 5,000 kw. for the Pinkston power station of the Glasgow Corporation Tramways, and 25,800 kw. for the L. & S.-W. Railway Co. The standard 4,000-kw. plant is illustrated in fig. 10 herewith.

The system is operated in two ways, called respectively the "Shunt" and "Series" systems. In either case, the air is extracted from the condenser by means of an ejector, the condensed steam being removed by a separate centrifugal pump from

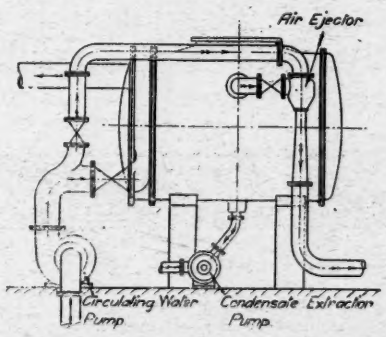



Fig. 11.—Willans Rotary Air-pump System—"Shunt" Arrangement.

the bottom of the condenser. In the shunt system, a portion of the circulating water is used to supply the ejector, while in the series system the whole of the circulating water is passed through the ejector, the choice depending upon other circumstances, but in neither case is a greater quantity of cooling water required than where other kinds of air pump are employed. The system is very simple, and it is claimed that it involves the minimum power consumption, without requiring a separate air pump or water tanks. Fig. 11 shows diagrammatically the lay-out of the "shunt" system.

## New B.T.H. Reflectors.

The British Thomson-Houston Co., Ltd., of Mazda House, Upper Thames Street, E.C., have recently placed on the market the Radial Wave Reflector, which can be used with any form of street lighting bracket, post or cable suspension equipment. With

Fig. 12.—B.T.H. Radial Wave Reflector.

ordinary reflectors a common defect is that they give a high intensity of light immediately under the lamps, which intensity decreases very rapidly until, midway between two posts, the illumination is quite inadequate. The B.T.H. Radial Wave Reflector, fig. 12, has been designed to overcome this difficulty, and its peculiar

Fig. 13.—Complete Radial Wave Reflector Unit with Suspension Pulleys.

construction enables it to project a much higher candle-power between the horizontal and an angle of 30° below the horizontal than the ordinary concave reflector. The reflector is made of stamped fluted steel with a reflecting surface of white vitreous enamel, and is painted green outside. It is provided with a heavy glazed porcelain hood, and is fitted with an Edison screw holder.

## Electric Heat Carpets.

The Schniewindt Electric Co., of 40 and 41, Staniforth Street, Birmingham, have sent us illustrated information respecting their "Stangerotherm" electric carpets for industrial and general domestic service, with a list of useful sizes ranging from 12 in. × 12 in. to 42 in. × 60 in., and a statement of approximate consumption in watts for three heats. Prices are also tabulated. It is claimed that heating from the floor is far better than that from radiators, as it does not leave the feet cold. The heat from the elements, of course, first warms the carpet. Abundant heat can be transmitted to the room without raising the temperature of the carpet beyond a comfortable warmth. The elements are liberally rated preventing the possibility of overheating. The Stangerotherm carpet is fitted with a small regulating switch by means

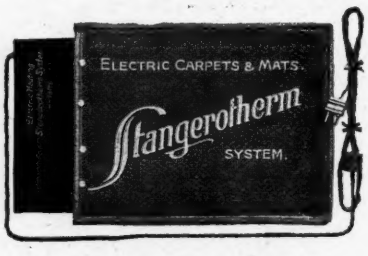



Fig. 14.—Electric Heat Carpet.

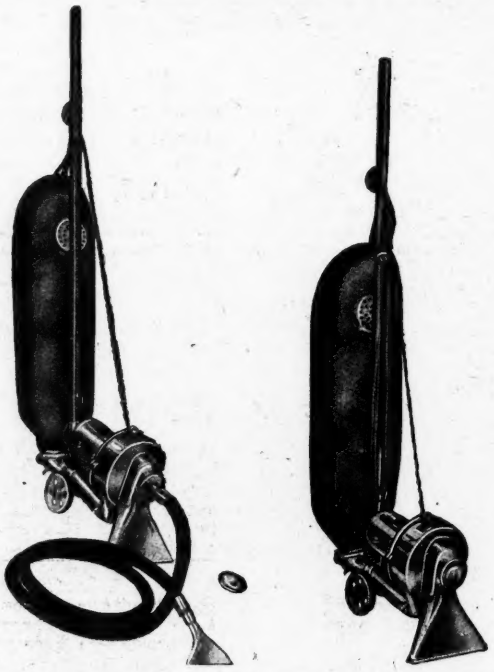
of which three different degrees of warmth may be secured. The heating elements, which are entirely separate from the carpet itself, are enclosed in watertight insulating envelopes, which are placed between the carpet proper, and a waterproof underlay fitted to the carpet and opened at one end to insert the element. Small elements can be fitted to any carpet at any spot required, such as near a desk, work-table, piano and so on. It is claimed that the energy consumption is very low owing to the low degree of warmth to which the elements have to be treated. For three positions of the regulating switch it is as follows:—1st position, 720 watts per sq. yd.; 2nd position, 360 watts per sq. yd.; 3rd position, 180 watts per sq. yd.

## The "Grei" Semi-Diesel Engine.

The Barlaw Engineering Co., Ltd., of 100c, Queen Victoria Street, E.C., are introducing the "Grei" semi-Diesel oil engine, which works on the two-cycle principle, and burns either crude oil or petroleum. The engine is very sensitively governed and well balanced, and is provided with forced lubrication. It is suitable for driving dynamos for country house installations and similar purposes.

## New Model "Magic" Cleaner.

As the result of experience with the earlier machines during the past three years, "Magic Appliances," Ltd., of 6, Farringdon Avenue, E.C., have brought out a new model of the "Magic" suction cleaner, in which many improvements have been embodied. Every part of the machine has been subjected to the most careful scrutiny and exhaustive experiment, with a view to producing a machine which shall be as nearly perfect as possible, combining reliability with efficiency and economy. A much more powerful motor has been employed, fitted with ball-bearings, and capable of standing a considerable overload. We have seen one of these motors, and it is really a little gem. The mode of attaching the hose for



Figs. 15 and 16.—"Magic" Cleaner, with and without Hose attached.

cleaning walls, &c., has also been greatly improved. Instead of clipping it under the nozzle of the cleaner, it is now connected to the front of the nozzle in a line with the centre of the fan, by means of a cone-shaped fitting (fig. 17), which completely prevents leakage and loss of suction, besides providing a direct path from the hose straight into the fan.

A patent antiseptic device is attached to the bag, containing a sponge saturated with "Florox," a germicidal fluid, which gives to the air of the room a pleasant odour. Hooks are provided for neatly coiling up the flexible when not in use, and the handle is linked to the machine by a chain which can be instantly adjusted

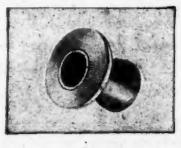


Fig. 17.—Hose Connector Cap.

in length. The motor bearings are provided with small Stauffer lubricators, which, however, rarely need be touched, and the brushes are of a most simple design. Owing to the extreme variety of voltages and frequencies in use in this country, a very large stock of cleaners has to be carried; some 500 are stocked in London for A.C. and D.C. The machines are made throughout at the company's works near Birmingham, and are tested during manufacture, on completion, and again before dispatch from the London warehouse, and are intended to be placed in the hands of any ordinary domestic without special instructions, being as far as possible foolproof.

## Novel Window Sign.

The Electrical Co., Ltd., of 122-124, Charing Cross Road, W.C., have placed on the market a novel shop-window sign for high-class advertising, embodying an entirely new and original idea especially suitable for display after closing time. It is composed of ½-in. plate glass, upon which any inscription, trade mark, &c., can be painted and renewed as desired. The novelty is that this inscription is illuminated from an invisible source, and can be hung at any convenient spot in the window like a picture. It is made in two sizes, and the plate glass is mounted in a bronze frame, with covers and holders for the Aegma drawn-wire lamps of tubular shape which are employed for illuminating it.

### Engineer's Handy Drill.

Every engineer of experience will appreciate the value of a drill that will enable him to drill out broken set-screws, pins, &c., in places where an ordinary ratchet drill cannot be used without dismantling much of the engine, pump, &c. The drill shown may be

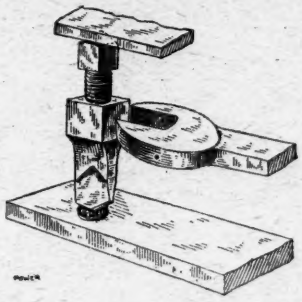


FIG. 18.—A HOME-MADE DRILL FOR NARROW PLACES.

made at the plant, and by having a few of different diameters and lengths on hand, many emergency repairs may be quickly made that would otherwise necessitate much time and labour.—*Power*.

### New High-Frequency Generator for Wireless Work.

A new high-frequency generator, lately described by Dr. Riccardo Moretti in *L'Elettricista*, is arranged as illustrated diagrammatically in fig. 19. The generator is a modification of the Duddell singing arc, but is distinguished from the latter and from Poulsen's generator, by the fact that continuous wave trains are not obtained from Moretti's apparatus.

The direct current arc is operated in series with a suitable ballast resistance, and is shunted by a capacity and inductance as shown. The positive arc electrode is hollow, and is traversed by a continuous stream of water (or other cooling liquid). The water cools the electrode, and on entering the arc, it is dissociated by the combined effect of heat and electrolysis, and an extremely rapid series of

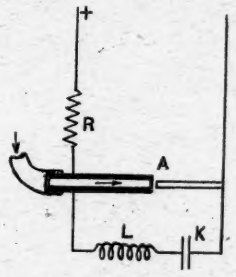



FIG. 19.—DIAGRAM OF GENERATOR.

explosions occurs in the arc, thus setting up energy surges, the frequency of which is said to be about 100 kcy. per second. These discharges in the arc circuit set up oscillations in the circuit KL of frequency $F = 1/T = 1/2\pi\sqrt{LK}$. The frequency of the arc discharges is generally considerably lower than the natural frequency of the oscillating shunt circuit KL, so that damped wave trains are obtained—more or less closely following one another according to the frequency of the arc discharge.

Hydrogen enclosure of the arc is not required. Using this generator, an hydraulic microphone and the usual arrangement of aerial, Moretti claims to have achieved satisfactory wireless telephonic communication from Centocelle (Rome) to Tripoli.

### Superlux Glassware.

THE GENERAL ELECTRIC CO., LTD., of 67, Queen Victoria Street, E.C., after a considerable amount of experimenting have brought out a new glassware, designed and manufactured on a scientific basis, which they have named "Superlux." This is a pure white glassware of exceptional reflecting and diffusing qualities, and the company claims that it has an absorption factor of only about 5 per cent. over the effective angle of illumination. It is manufactured in a variety of forms and sizes for use with lamps of every candle-power, and is applicable to all existing systems of lighting, such as direct, indirect or diffuse. The inner or reflecting surface is of a dull, unpolished nature, which is produced in the manufacturing processes; the outer surface has a subdued polish which, combined with its pure whiteness and texture, produces a pleasing effect. It can easily be adapted to existing installations.

**Lectures.**—Mr. A. C. Huckstepp, principal of the Forward Publicity Committee, began a course of classes in "Advertising and Salesmanship" at the Birmingham Y.M.C.A., on Wednesday evening.

## CORRESPONDENCE.

*Letters received by us after 5 P.M. ON TUESDAY cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

### A Charge Engineer's Complaint.

It is to be hoped that the following little article may have some effect in preventing some of the younger fellows in central stations from trying to get on, trying to get a charge engineer's job.

Recently a charge engineer in a generating station, three-phase, D.C., and traction, resigned. At this particular time the three engineers were respectively, a B.Sc. (Vict.), a Faraday House man, and another University graduate.

In place of the man who resigned, an engine driver in the station was appointed "shift," permanently, not *pro tem.* The vacancy was not advertised.

This will serve to show what our chief electrical engineers think of the man who has obtained excellent technical education combined with thorough works training, and it also shows many young fellows engaged in power station work the utter uselessness of trying earnestly to improve their positions so long as such appointments are made.

At this station it has been customary for some years to take pupils, the expenses of the pupil being about £100 per year, and it was usually stated on one's articles that such pupils would be given reasonable preference over other applicants for a vacancy, when one occurred, provided, of course, that the pupil had made himself proficient. The writer is a past pupil who has made himself very proficient in power station work by reason of mechanical work, pupilage, insight into work of other concerns, and technical education, the total cost of which would come to some hundreds of pounds, yet an engineman, pure and simple, is given the post of charge engineer, before a single other fellow even hears of there having been a vacancy.

This serves to show that decently trained men are not required in power stations, and the sooner it is recognised the better; it shows up the premium pupil game very clearly.

**James Fredericks.**

### Apparatus on Hire.

In reply to Mr. H. S. Ingleby's criticism of the article on this subject I should like to make a few comments.

It has not been my experience that a corporation can buy motors at a considerably lower price than other traders. As a matter of fact, the company from whom the Govan Corporation purchased the majority of their motors gave them no better terms than they gave any engineering firm in the neighbourhood.

Mr. Ingleby (I am sure, unintentionally) misrepresents me when he says that I advocate running a hiring department at a loss. He cites the fact that after all charges in connection with the Govan hiring department had been paid there was only a small credit balance, which is correct, but he, perhaps, overlooked the fact that in addition to the sinking fund, a depreciation fund equal to an average of 6·08 per cent. per annum was formed, and this was certainly more than was necessary for safety.

He says that no charge was made for supervision, and in this, no doubt, my statement that nothing was allowed for the mains superintendent's time misled him, and I ought, perhaps, to have been more explicit on the point. The motor attendant was a first-class wireman who had been through the armature winding shops of one of the principal electrical firms in the country and needed very little supervision, and, consequently, the amount of time the mains superintendent gave to the work was very small, but the motor attendant's time was all fully allocated. It should be noted also that I was not holding up the Govan undertaking as a model, and under the heading of rental charges, I gave what I consider to be sufficient to cover every charge. In this, I allowed 3·28 per cent. for establishment charges and capital charges on stock motors, which, I think, is quite sufficient. The other items, sinking fund (depreciation in the case of a company) and repairs, would be the same for either corporation or company,

E

and 3·5 per cent. is sufficient for interest for a corporation, but I quite agree is *not* sufficient return for a company trading to make its profit out of hiring, so that I think the matter boils down to whether a corporation should undertake a trading concern, such as an electric supply or not, and this question I am not prepared to argue!

I do not think that the local traders had any complaint to make against the Govan electricity department, and our relations with them were always very friendly, including those with a firm that hired out small motors.

If there is a company in the district who will hire out motors of all sizes, there is no necessity for a corporation to hire, but there are relatively few of such companies, and where there are none, the supply authority, be it company or corporation, should undertake the work itself.

With regard to reliability, &c., my remarks hold good whether the hiring authority is corporation or company, and I had not the slightest intention of reflecting upon hiring done by a company, as Mr. Ingleby seems to think. In the case of the Govan Corporation, the motor attendant was a fully qualified and very excellent workman, who was paid the standard rate of wages, and, in my opinion, such a man should always be employed.

With regard to the stock of motors being small, I can assure Mr. Ingleby that it was quite sufficient, and that we never had any trouble from breakdown on that account. As I pointed out, our practice was to obtain our motors as much as possible from one firm, and with that arrangement, if you have eight sizes in stock and a good assortment of pulleys, you can do a good deal. I should, perhaps, have emphasised more that, given first-class motors and efficient inspection, the spare motor problem largely disappears, and with this I think Mr. Ingleby will agree.

I should be interested to know if Mr. Ingleby, with his experience at Leeds, takes exception to the article regarded simply as detailing a hiring scheme, disregarding the paragraphs relating to municipal ownership.

**T. C. Parsons.**

Exeter, *September 19th*, 1913.

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### "Continuity."

If the graceful rebuke meted out by yourselves to your correspondent under the above title in this week's issue does not close your columns to this subject matter, permit me to express my opinion that the £5 and "Tosh" will not part company.

It is, indeed, regrettable that our friend fails to comprehend the poetical language and the inner meaning of the impressive close of Sir Oliver Lodge's eloquent address. He has yet to learn that money will not bring a man into tune with the Infinite, neither will it furnish the "evidence" he requires to prove "statements and assertions."

When one reads that the President's pronouncements were given as the result of over 30 years' research, surely it must be admitted that no man has a right to dispute the conclusions before studying the evidence, especially when the pronouncements do not travel beyond the boundaries of the researches.

Difficulties and confusions arise from the general disposition to assign limits, where there are no limits. Your correspondent will have to pass the boundary line of the physical before his perceptive faculties are attuned to more subtle influences. Happily, there are many who consider the Presidential address an excellent augury for the expansion of science.

**H. E. Yerbury.**

*September 20th*, 1913.

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Permit me—a reader of the Electrical Review since 1876—to associate myself with your protest against the sentiments of your correspondent with the self-bestowed name "Tosh" who, in your current issue, criticises Sir Oliver Lodge's recent Birmingham discourse, and your own leading article (September 12th) dealing with the same.

It is a pity that your favourable reception of Sir Oliver's weighty and courageous utterances should, by your correspondent, be made the occasion for words not only crude and ill-mannered, but calculated also to stab the religious convictions of thousands of your readers.

"Tosh" and hectoring fellows of his class—overweening in cheek and exaggerated sense of their own importance and numbers—ever seek with negative dogmatism, and futile abuse of anything beyond their own restricted vision, to disturb by sheer vulgar noise the serenity of fellow men who are believers in God and the happy future awaiting all who, according to their lights, do their duty in this life.

Even from the commonplace point of view of existing conditions the conduct of "Tosh" has its ludicrous aspect, for he appears to be ignorant of the fact that even in our own restricted English electrical world, many of the foremost men therein are convinced Christians: men predominating, too, among the writers of the most up-to-date electrical literature. As a pledge of *bona fides*, I append to this letter, for the eye of you personally, Mr. Editor, a list of some of these men, as well as further corroborative details relating to other statements in this communication. Even with my own very restricted personal knowledge regarding the intimate convictions of others, I can point to "Believers" among past Presidents and other eminent men in the I.E.E.; apart, too, from Lord Kelvin, who, by his famous profession of Faith uttered in the Sheldonian Theatre at Oxford, proved his mettle. All these men believe in the reality of the unseen world, and of many facts in the spiritual order at present beyond their ken. Yet are they any the less keen in the pursuit of science? . . . .

All this, Sir, may "sound to" your correspondent "like Tosh," but does he still think that this word is applicable to beliefs which have energised the lives of Damien among the lepers, Dolling in the East End, Stanton in the back streets of Holborn, Booth among the outcast and Spurgeon in much earnest work?

**E. Raymond-Barker.**

London, *September 21st*, 1913.

[We have ventured to abbreviate our correspondent's remarks, and close this discussion for two reasons: first, because we do not think it a suitable matter for extended treatment in the columns of a technical journal, and, secondly, because experience tells us that if we give our correspondents the reins, there will be no room for anything else in the journal.—Eds. E.R.]

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With your permission I will quote a few extracts from Carlyle's "Sartor Resartus," which, I think, will sufficiently explain the passage in Sir Oliver Lodge's address, which your correspondent "Tosh" regards as unintelligible; and incidentally, perhaps, earn that £5 for the I.E.E. Benevolent Fund!

Nature, with its thousandfold production and destruction (is) . . . . what the Earth-Spirit in *Faust* names it, *the living visible Garment of God*:

. . . . . I walk and work, above, beneath
Work and weave in endless motion!
Birth and Death,
An infinite ocean;
A seizing and giving
The fire of living:
'Tis thus at the roaring Loom of Time I ply,
And weave for God the Garment thou seest Him by.

Of twenty millions that have read and spouted this thunder-speech of the *Erdgeist*, are there yet twenty units of us that have learned the meaning thereof? . . . .

The thing Visible . . . what is it but a Garment, a Clothing of the higher, celestial Invisible? . . .

It is written, the Heavens and the Earth shall fade away like a Vesture; which, indeed, they are: the Time-Vesture of the Eternal.

William Watson embodies the same idea in a little poem entitled "The Questioner":—

I asked of Heaven and Earth and Sea,
Saying: "O wondrous Trinity,
Deign to make answer unto me,
And tell me truly what ye be."
. . . .
And they made answer: "Verily,
The robe around His form are we. . . .

**Musicus.**

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### Lightning Conductors at St. Paul's Cathedral.

The description given in the Review of September 5th is rather *ex parte*, and conveys the impression that the installation which was carried out by the cathedral staff to

my specification in 1900 was left incomplete. The authorities would not permit new conductors to be carried down the outside walls, so they were rearranged in the ducts, and were so interconnected with the new cables on the roof that they formed a "modified bird cage" protection.

Cable conductors have the advantage of durability, which tape does not possess, and those at St. Paul's, when I last tested them, were in perfect electrical condition; the contractor would have given better value had he not made a change to tape. Both on the Continent and in the United States lightning rods are, as a rule, of solid rod or cable, the use of tape is very limited, as the "neat job," which pleases the architect, of running out and in over the projections of the building has long been condemned by scientific Committees in many countries, as well as by the Lightning Research Committee (1905 Report) and Phœnix Insurance 1910 Rules.

Pieces of the original iron rods, said to have been designed by Franklin, also samples of the copper conductors, can be seen in the Science Section of the South Kensington Museum. A specimen of modern copper tape, deteriorated so as to be almost a non-conductor after about ten years' exposure, is also exhibited.

**Killingworth Hedges, C.E., M.I.E.E.**

St. Stephen's Club, S.W.

### Greatest New York.

On page 422, "The New York Edison Co.," total area of more than "25,000 sq. miles"—bit of a stretch isn't it, even for a Yankee? Perhaps you can confirm it?

**V.**

### The "Hand" of an Armature.

However "eminently desirable" it may be to obtain uniformity in the use of the names right-hand, left-hand, progressive, retrogressive, as applied to armature windings, it is very unlikely that such a uniformity ever will be reached, for the reason that the suggestions of Mr. MacCallum, as supported by certain text-books, differ from the existing standard practice of several leading manufacturers in this country. The existence of specifications, drawings, records, &c., which assume the use of this standard practice, makes it practically out of the question that manufacturers would change their present methods.

All that can be done, unfortunately, is simply to make a note of the fact that this nomenclature varies, so that one will not be led astray when the names are encountered with a different meaning to that to which one has been accustomed.

**G. Moores.**

Stockport, *September 20th*, 1913.

[Our correspondent tells us that there is a "standard practice," but that the nomenclature varies—statements which are rather inconsistent. Surely it is eminently desirable that uniformity of nomenclature should be achieved by some means or other, whether Mr. MacCallum's suggested system or another be adopted. From the last paragraph of Mr. Moore's letter it appears that at present chaos reigns in this respect. The matter might appropriately be taken up by the Electrotechnical Commission.—Eds. Elec. Rev.]

### Electric Train Lighting in Switzerland.

The following facts *re* above may be of interest:—Electric lighting has been universal on all broad-gauge railways for many years. Narrow-gauge lines, other than electric, also use it almost exclusively, the exceptions being a few small lines where *oil lamps* are still in use.

Electric lighting was in universal use on the broad-gauge lines long before the State began, in 1903, to buy up the companies. The latter, therefore, bore the whole expense of equipment. Moreover, the electric lighting of trains was universal long before the introduction of the train-lighting dynamo. It entailed the use of interchangeable accumulator cases fixed under the carriages. The latter system is still in use on part of the older rolling-stock.

**D. A. Stewart Sandeman, C.E. (Laus.).**

Lausanne, *September 21st*, 1913.

### The Metalite Meeting.

I have to-day returned to London after a holiday and notice a letter from a shareholder of "Metalite." I shall have pleasure, with your permission, in answering the questions raised during next week.

In the meantime you are at liberty to publish my address.

**F. Harrison.**

14, Dickenson Road,
Crouch Hill, London, N.
*September 23rd*, 1913.

## LEGAL.

### Colliery Electricians' Duties.

Sheriff Shennan, at Hamiltion, has given his opinion on the objections to the relevancy in the summary complaint against James McNeil, colliery electrician, Wishaw, superintendent of the electrical plant at Dalzell and Broomside Colliery, Motherwell, who is charged, along with Robert Wilson Dron, mining engineer, Bearsden, and James Dalgleish, manager of Dalzell and Broomside Colliery, with having, between March 15th and April 16th last, contravened the Coal Mines Act by failing to take certain precautions in connection with the colliery plant. Certain objections to the complaint against Messrs. Dron and Dalgleish were reserved pending the prosecutor amending the complaint. Of the eight charges against Mr. McNeil, it was held that seven were irrelevant in respect that in these Mr. McNeil was accused of "failing" to have certain things done or supplied in connection with the electrical plant, whereas the rules clearly defined the electrician's duties as being those of examination and testing, and also keeping a log book. Sheriff Shennan stated that, in his opinion, this objection to the relevancy fails to be sustained. Before a breach of duty can be charged the prosecutor must be able to point to the section of the Act, or the special rule or rules which impose the duty. He failed to find any duties specially imposed on the electrician except those contained in sub-heads (*c*) and (*d*) of Special Rule 14, viz.:—(I) The thorough examination of all apparatus as often as may be necessary to prevent danger; and (II) the examination and testing of new apparatus and of apparatus re-erected; and (*d*) the keeping of a log book. His Lordship did not find what he might call executive duties imposed on the electrician. It seemed to his Lordship that the scheme of the rules was to put the electrician in the position of technical adviser, and the results of his examination and inspection being entered in the log book, it then became the manager's duty to see that the necessary work was carried out. To the remaining charges against Messrs. Dron and Dalgleish, and the eighth charge against Mr. McNeil, viz., of failing to make a thorough examination of the electrical plant, a plea of not guilty was tendered, and the trial was fixed for the 26th inst.

**Lead.**—Messrs. James Forster & Co., of 141, Fenchurch Street, E.C., in their lead report dated September 20th, state: "Closing prices last week were £19 12s. 6d. September, £19 15s. October, and £19 7s. 6d. November. Monday's market opened firm, with a rise of about 10s. a ton on the day for September lead, this prompt selling at £19 17s. 6d. to £20 5s., and has remained strong throughout the week, closing at £20 15s. for September, £20 7s. 6d. for October, £19 17s. 6d. for November, and £19 10s. for December. The demand has been large, particularly for export, for which heavy sales have been made to Europe and the East, and home consumers, who are not at all well supplied, have also bought freely. For September/October, for which months we believe there is a considerable 'short' account open, the prospects are anything but inviting for 'bears.' We anticipate higher prices for all positions this year, with continued scarcity of early lead. English lead, £21."

**Electric Elevators in the Transvaal.**—According to the *African World* there are now 139 elevators at work in buildings in the Transvaal, of which 128 are in Johannesburg; 134 are of the electric type, while four are hydraulic power and one steam driven. A departmental report states that in the types of machinery installed in the new elevators a great improvement is noticed, due to the employment of firms of repute.

## ELECTRIC VEHICLES.

We have received the following interesting communication, to which we refer in our leading columns :—

At the annual general meeting of the Incorporated Municipal Electrical Association held in June last, the following resolution was passed unanimously :—

"That a Committee be appointed by the Council to consider and adopt such measures as may be found desirable to further the use of the electric battery vehicle. That such Committee be empowered to co-opt representatives of other institutions, company-owned electric supply undertakings, manufacturers and others directly interested in this matter."

The Committee referred to has been appointed, and at the first meeting the President of the Incorporated Municipal Electrical Association—Mr. R. A. Chattock, city electrical engineer of Birmingham—was elected chairman, and it was also decided that, in addition to the seven members of the Municipal Electrical Association forming the present Committee, the following additional members should be co-opted, representing—

| | |
|---|---|
| Company-owned electric supply undertakings in the London area ... ... ... ... | 2 |
| Ditto in the provinces ... ... ... ... | 1 |
| Manufacturers of electric storage batteries ... | 2 |
| Manufacturers of electric (battery) vehicles ... | 3 |
| The Royal Automobile Club ... ... ... | 1 |
| The Automobile Association and Motor Union ... | 1 |

As Messrs. Edmundsons' Electricity Corporation appear to be interested in the greater number of the company-owned electric supply undertakings in the provinces, the Committee consider that the present requirements of the case are met by asking Messrs. Edmundsons to nominate one of their technical staff to serve on the Committee as representative of the provincial companies.

It is proposed that the scope of the Committee's work shall, at the outset, cover the following :—

1. To get into communication with electric supply authorities throughout the United Kingdom, and to impress upon them the desirability of taking energetic steps to encourage the use of the electric vehicle by :—

(*a*) Agreeing to supply electric energy for charging purposes at a reasonable price.

(*b*) Calling meetings of the motor-car traders and hotel proprietors in their districts in order to induce them to provide charging facilities.

(*c*) At the outset, giving assistance to motor-car traders when the latter may be confronted with difficulties in connection with electric vehicles.

(*d*) Advertising the whereabouts of charging stations at all main road entrances to each town.

(*e*) Impressing upon municipal bodies and others employing means of transport in their respective areas, the advantages attending the use of the electric vehicle.

(*f*) Distributing information and literature among likely users. (The Committee have in view the hope of being able to compile and supply literary matter for this purpose.)

(*g*) Providing charging outfits on hire.

2. (*a*) To decide upon the best arrangements to recommend for charging.

(*b*) To decide upon the most suitable sizes of a line of charging outfits :—(1) For D.C. systems ; (2) for A.C. systems ; which, in order to eventually reduce cost of manufacture, could be recommended as standard sizes.

(*c*) To secure, as far as possible, simplicity, clearness and uniformity in battery charging instructions.

3. To consider the issue of rules for the proper use and maintenance of electric vehicles.

4. To consider and make recommendations for the standardisation of the technical details connected with the design of electric vehicles :—

(*a*) Standard ratings for motors.

(*b*) Standard voltages.

(*c*) Standard ratings for commercial vehicles (carrying capacity and speeds).

(*d*) Wiring details.

(*e*) Standard charging terminals.

(*f*) Standard battery units.

(*g*) Electric lighting on electric vehicles, &c.

5. To approach the insurance companies with a view to inducing them to quote specially favourable rates for insuring electric vehicles in consequence of the reduced fire risk, &c.

6. To arrange, if possible, for periodical parades and exhibitions of electric vehicles.

7. To collate useful information in regard to electric vehicles and to publish same from time to time.

8. To take up with the authorities concerned the question of the rating of electric vehicles for taxation purposes.

9. To arrange for the issue of maps with charging stations indicated, together with list of the latter and tariffs.

10. To consider any other matters connected with the electric vehicle.

In regard to the constitution of the Committee, there does not appear to be any society or institution in this country representing the manufacturers of electric storage batteries which could be asked to nominate representatives to serve on the Committee, and the same remarks apply in the case of manufacturers of electric vehicles. It is proposed, therefore, to ask firms dealing respectively in batteries and electric battery vehicles to meet and choose representatives to serve upon the Committee. In order that such meetings may be convened at an early date, I should be glad if the firms interested would communicate with me as soon as possible. It is, of course, understood that where the manufactory is situate abroad, the properly-accredited agents in this country are referred to in the term "firm" mentioned above.

The Committee desire me to say that they will, at all times, be glad to receive and consider any suggestions which may assist in this "forward" movement connected with the use of the electric vehicle. Any communications should be addressed to the undersigned.

F. Ayton,

Hon. Secretary of the Electric Vehicle Committee of the Incorporated Municipal Electrical Association.

Chief Engineer and Manager, Corporation Electric Supply and Tramways Departments, Ipswich.

## BUSINESS NOTES.

**A Blow to the German Export Trade.**—The German Home Tax on lighting materials is proving a serious handicap to the German export trade, more particularly that to the United States and Canada. In both of these countries for some time past the Customs Authorities have added this tax to the value of German exports in calculating the import duties, the effect of which is to increase the net selling price of German goods by from 30 to 50 per cent., and to practically shut the German goods out of those markets. The value of the lost trade is placed at at least £150,000. Representations by the German Government to the Governments of Canada and the United States have failed to secure an amelioration. An evil side to the question is that other countries may be led to adopt similar methods, when the blow to the German export trade will be incalculable. Failing the revocation of the tax by the Imperial Government, the only alternative before the German electrical material industry will be to transfer their works abroad, when the Fatherland will presumably lose much more than the £1,650,000 which the tax now brings in. The Union for the Defence of the Economic Interests of the German Electrotechnical Industry, and the Vereinigung der Glühlampfabrikanten, are taking active steps in this matter, and have presented a petition to the Reichstag urgently pressing for the repeal of the tax.

**The Edison Battery.**—The Edison Storage Battery Co., of Orange, N.J., U.S.A., has just brought out a new type of the well-known Edison accumulator. The new type or size is known as A5 and has a rated capacity of 187½ ampere-hours ; it is designed for use on pleasure cars, light delivery vans, industrial and luggage trucks and similar work.

**Fire.**—The drying sheds at the timber mills of Messrs. Beecroft & Wightman, of Hull, were gutted by fire on 19th inst., but it is understood that arrangements have been made for business operations to continue as usual.

**Coating Metals with Lead.**—Lead, Ltd., of 1 and 2, Old Pye Street, Westminster, has acquired from Mr. Sherard Cowper-Coles the sole right for the coating of iron and steel with lead by an electrolytic process. Lead by this process can be economically deposited up to the thickness of ⅛th of an inch. A plant has been erected in London for the coating of sash bars for window frames and for metallic glazing for roofs. Brass, copper and other metals can also be coated with lead, and the process is suitable for protecting the lining of pipes, tubes and chemical vessels for containing and conveying corrosive liquors, as well as for the coating of earthenware and wood, and the protection of ornamental ironwork.

**Lundberg Switching Competition.**—We understand that a very satisfactory number of papers from candidates in the United Kingdom has been submitted in connection with the above ; and the results of the competition will be published in our "Advertisement Columns" in the first week of November. Papers from the Colonies and abroad are not due in till February 2nd next.

**Trade in Germany.**—It is stated on behalf of the Bergmann Electricity Works that the course of business in recent months has been normal, the turnover being about on the level of last year. Large transactions are somewhat more scarce, but compensation is obtained from the partially more active business in the so-called merchant products. In particular, the departments for machinery, installation material and cables are satisfactory, but the company has refrained from financing works since the Bergmann Electrical Enterprises Co. restricted itself to the completion of old transactions.

**The Glow Lamp Industry in Austria.**—On the course of business in the glow lamp industry in Austria, the *Elektrotechniker* remarks that that branch is among the few which have been unaffected by the Balkan war. Demand, especially for metal-filament lamps, was fairly active. In the mass, as the technical methods of producing the metal-filament lamp are perfected, the domain of utility of the carbon lamp will be restricted. The chief users of the latter are those manufacturing industries where the lamps are exposed to strong vibrations, such

as mills, mines, &c. Elsewhere the metal-filament lamp is ever gaining new ground. The price, which, for the most used kinds, a year ago was about 3 kronen, has come down to between 1 and 1·10 k. It has lately become possible to make the high candle-power filament lamp economically and this renders a competition with the arc lamp possible. Austria-Hungary's present output of these lamps, which totals between 18,000,000 and 20,000,000 a year, far exceeds the consumptive powers of the Monarchy which amounts to only about half of this quantity. The export business, which embraces all quarters of the earth, shapes itself satisfactorily. But in many export markets the competition of Germany is being more and more felt. The carbon lamp Cartel, in which German, Austro-Hungarian and Dutch firms are represented, expires in May next year, and it seems little likely that there will be a renewal of the same. That is to say, most manufacturers are of the opinion, that with the altered circumstances in the glow lamp industry, free competition will prove itself to be the better policy.

**Water Softeners.**—Messrs. Lassen & Hjort, of 52, Queen Victoria Street, London, E.C., have sent us a lengthy list of firms and undertakings which are at present installing their automatic water softeners, orders having been received from them during the past few weeks. The list includes three further plants for the Government for Woolwich Arsenal; seven plants for Messrs. Babcock & Wilcox, Ltd., who have exclusively adopted the L. & H. softener and supply it under licence; and installations for important colliery owners, iron companies, paper mills, rubber companies, laundries, &c., the Royal Exchange, London, and the Rochdale and Wakefield Electricity Works. The Lassen-Hjort softener is an automatic device giving direct positive measurement of both hard water and chemicals in separate adjustable quantities: and it is claimed that by means of this apparatus it is possible to treat any water or effluent with any reagent in rigidly proportionate quantities which can be varied at will and regulated with precision. This water purifying plant has been installed by the British Admiralty at Portsmouth and Hong-Kong, by the French War Office at Rochefort Arsenal, by the Japanese Admiralty at Kobe Dockyard, and by the Italian Admiralty at Castellamare.

**Lamp Test.**—At South Shields, recently, three large shops adjoining each other were completely gutted by fire. The stocks were particularly inflammable, consisting of millinery, furniture, boots, &c., and the fire was so fierce that the wiring in all the shops was completely destroyed, but the Osrams in the outside fittings were not damaged. The heat caused the opal globes to burst, and molten lead from the roof fell upon one of the fittings; later a blazing sun blind crashed on top of it, but the lamps withstood successfully the severe tests of fire and water.

**Bankruptcy Proceedings.**—Jack Francis Barnes, electrical and mechanical engineer, picture house proprietor, &c., Oldbury, Worcester, and Cradley Heath, Stafford.—Mr. Registrar Walker held a sitting at the Law Courts, West Bromwich, on September 19th, for the public examination of the above debtor. In reply to the Assistant Official Receiver, the debtor said that in 1895 he commenced the business of cinematograph entertaining at the Victoria Pier and the Empire, Blackpool. Since then he had run cinema entertainments in nearly every city and large town in England, Scotland and Wales. About 14 years ago he settled at Walthamstow, London, and worked his business as an electrical engineer from there. For about eight years whilst in London he ran cinema shows, principally at music halls in London and the provinces. When he left London, six years ago, and went to Smethwick, he was in debt to the extent of £400 to £500, all of which he was able to pay off within 12 months. He was engaged at the Aston and Smethwick Theatres for about 5½ years, and during that time he supplied films and electrical apparatus in the district. In August, 1909, he joined Mr. Richard Nightingale, of the West Bromwich Theatre Royal, and they took premises at Cradley Heath for a picture house. Reference was made to other picture palace ventures. Bankrupt attributed his failure to keen competition in the cinematograph business, and loss on picture houses, and at the date of the receiving order 17 judgments had been entered against him. In seven cases committal orders had been obtained. He admitted that he had possessed a motor-car which he took in payment of a debt, and which he subsequently sold for about £37. His wife now had a motor-car, which she purchased out of her own private income, she having been left altogether three fortunes, and the furniture also belonged to her. He denied that he had been extravagant. His deficiency was £423. The debtor was allowed to pass.

Frederick Thomas Johnson (described as Frederick Johnson in the petition), electrical engineer, 60, Eltisley Avenue, Newnham, Cambridge. The public examination of this debtor was fixed to take place at the Guildhall, Cambridge, last week, before Mr. Registrar Eaden, but was adjourned.

Joseph Swainson, an electrical contractor, 22, Booth Street, Manchester, and 10, Wilton Road, Chorlton-cum-Hardy.—This matter came before Mr. Registrar Atkinson, at the Manchester Bankruptcy Court on 19th inst., when the debtor was publicly examined as to the causes of his insolvency. The statement of affairs showed a deficiency of £1,044 upon unsecured liabilities estimated at £1,371, and he alleged that his failure was due to losses on contracts, bad trade, special allowances to book debtors to obtain cash, bad debts (£300 in the last 12 months), and increased cost of material after the accepting of contracts. In answer to the Official Receiver (Mr. J. Grant Gibson), the debtor confessed that he was unable to explain how a surplus capital of £418 18s. shown in a balance-sheet prepared by his accountant as on January 31st last, had been converted in so short a time to the deficiency shown in his statement of affairs. The Official Receiver suggested that as a matter of fact the debtor had been living in a fool's paradise. Debtor replied that he had relied on the balance-sheet prepared by his accountant. The Official Receiver pointed out that the accountant could only prepare a balance-sheet from information supplied to him by the debtor. The examination was closed.

Francis Hastings Medhurst (deceased).—Trustees' (F. W. Pixley and F. S. Salaman) release dates from August 18th.

Alfred Wilson Hughes, 49, Queen Victoria Street, E.C., manufacturer of ebonite and electrical insulators.—The first meeting of creditors was held on Monday at the London Bankruptcy Court under a receiving order. Mr. W. P. Bowyer, Official Receiver, reported that since 1893 the debtor had been interested in a number of patents relating to incandescent gas, the maturing of whisky, a non-flammable celluloid, a patent varnish and electrical insulators. In January last he purchased at the price of £3,500 the machinery and patents for a substance called "Pluton," a substitute for ebonite. He paid a deposit of £500, and agreed to pay the balance of £3,000 on the assignment by the vendors to him of the whole of the patents. It subsequently transpired that the vendors did not hold the patents absolutely, and that Mr. A. R. Muller, the inventor, who held one-half interest in the patents and machinery, declined to execute the assignment, there being a debt due to him by the vendors. For that reason the assignment to the debtor had not yet been completed. He had expended over £3,000 in erecting plant and machinery at the factory at Walthamstow, where the business was now being carried on. He had received an offer for the business of £8,000 cash and £10,000 in shares of a proposed company, and also an offer for the purchase of the Canadian and American rights when the assignment was completed. His present difficulties were brought about through lack of sufficient capital to carry through the various businesses in which he had been interested, and in connection with which he had borrowed money on bills. No statement of affairs had been filed, but the debtor roughly estimated his liabilities at between £5,000 and £10,000 and his assets at £30,000. He consequently did not admit insolvency, being of opinion that if the assets were realised to advantage they would produce sufficient to pay off all the debts and provide a large surplus for himself. They included the plant, machinery and stock of ebonite insulators at Walthamstow, £3,000; cash, £500, deposit on the purchase of the patents; and a one-half interest in the Pluton Co., £20,000. The meeting was adjourned for a month with a view to a proposal being formulated and submitted to the creditors.

E. J. Crosier, engineer and merchant, Newcastle-on-Tyne.—October 9th is the last day for receipt of proofs for dividend by Mr. J. A. Gardner, the trustee, 145, Pilgrim Street, Newcastle-on-Tyne.

**Trade Announcements.**—From 29th inst., all correspondence for Messrs. Turner & Burger should be addressed to 149, Farringdon Road, London, E.C., where they have taken larger offices and warehouses.

In our last issue we recorded the registration of a new company formed for the purpose of dealing effectively with the question of the letting out of electric motors on hire, about which there was some discussion before the Leeds City Council last year. This new company, The Electric Motor and Stove-Hiring Co., Ltd., hopes to take a very active part in popularising the use of electricity for power and domestic purposes, and the motors supplied are made entirely in Leeds.

Messrs. Irwin & Jones, engineers and agents, of 5, London Wall Buildings, London Wall, E.C., are moving to larger premises to-day, and their address in future will be London House, New London Street, E.C. Their new telephone number is 1449 Ave; telegraphic address, Irwijos Fen, London.

**Liquidation.**—Electric Ignition Co., Ltd.—A meet- will be held at 131, Edmund Street, Birmingham, on October 28th, to hear an account of the winding up of the liquidator, Mr. R. A. Felton.

**For Sale.**—The goodwill, stock-in-trade, patents, &c., of the XL Electric Co., Ltd., is to be sold by tender, pursuant to the order of the Court, of July 29th. See our advertisement pages to-day for particulars.

**Lamp Contracts.**—The Edison & Swan United Electric Light Co., Ltd., have recently secured orders for Royal Ediswan lamps from the British Admiralty, the General Post Office, British L.M. Ericsson Manufacturing Co., and the United River Plate Telephone Co., Ltd.

**Annual Outing.**—The employés of the electrical department of Messrs. J. Stone & Co., Ltd., of Deptford, went for their annual outing on Saturday, 12th inst., by brakes to Downe, where, before tea, a football match was played; after a ramble, a programme of music and song was rendered at the Queen's Head Hotel.

**Tungsten Lamp Price Reductions.**—On Monday last a general reduction was made in the prices of metallic-filament lamps. The General Electric Co. inform us that this has been made possible by further technical progress in connection with drawn-wire filaments, combined with the increased output of the Hammersmith Osram Lamp Works. The reduction amounts to 4d. on the list prices of most of the smaller sizes of lamps, and 6d. to 1s. on the larger sizes. The front cover of the new Osram price list bears a striking picture showing effectively how the exertion of powerful muscles fails to break the filaments of the Osram lamp. A card gives a list of 12 actions commenced by the Osram Lamp Works, Ltd., on the score of infringement, as well as of three actions

in which judgment has been given in their favour, and one in which an interim injunction has been granted.

Messrs. Siemens Bros. Dynamo Works, Ltd., announce a similar series of reductions in the prices of their Wotan drawn-wire lamps, which apply also retrospectively to stocks held unsold by retailers on September 22nd, provided they had been bought direct from the makers, and that notice was given on or before yesterday. A corresponding reduction has been made in connection with certain types of tantalum lamps, amounting to 3d. in each case, and a special price list has been issued containing the particulars regarding both lamps. Price lists will be over-printed for trade customers on request.

The Electrical Co., Ltd., also send us their list of prices reduced in accordance with the foregoing statements, applying to the Aegma drawn-wire lamps, other makers of tungsten lamps, and tantalum lamps.

We understand that the prices of the Mazda lamps have been reduced by the British Thomson-Houston Co., Ltd., as well as the lamps made by the Edison & Swan United Co. (from whom, as we go to press, a price list showing the reductions, comes to hand), and other makers. Details are given in our advertisement pages to-day.

**Competition in Wire Lamps in Germany.**—The trade contest in wire lamps in Germany is now very keen. It prevails both among the small firms themselves and between the small firms and the large firms, as well as between the three largest producers. Indeed, although the latter have participated since 1911 in the combined German-American patented process for the production of drawn wire, or its method of application, the patent agreement has not led to the conclusion of a formal price syndicate. The present depression in prices dates back to last April, when the list prices of the leading firms were reduced by about 30 per cent., but, on the other hand, the discounts to retailers were reduced by 10 per cent. The fall in prices has not been fully equalised by an increased turnover and improvements in manufacturing, so that the profits earned per lamp have largely declined in those cases where profits have been realised, whilst in instances where losses have been incurred, these have become greater. The small lamp factories mostly use the squirted filament, but where this practice does not prevail, legal proceedings are in progress in regard to the process used. In any case, it is only possible to secure the continuance of the sales of the less durable lamps to contractors, by offering them larger profits on the business done, and the under-selling which thereby results forces the large producers to adopt a similar attitude. It is considered that the prospects of forming a syndicate for wire lamps, similar to that which exists for carbon-filament lamps, are not very favourable, owing to the wide divergence of the interests of the individual makers.

**Catalogues and Lists.**—The Sun Electrical Co., Ltd., 118 and 120, Charing Cross Road, London, W.C.—Catalogue No. 248 is an abridged issue (32 pp.) of their catalogue of switchgear and fuseboards, containing illustrated descriptions and prices of an extensive range of distribution boards, switch and fuseboards, main switches, ironclad switches, &c., for domestic and industrial purposes. In addition to the boards for ordinary standard requirements, special designs to comply with the latest Home Office Regulations are also included. A second publication (No. 249), of 12 pages, particularises prices and gives illustrations of a new range of reflectors—"Superlux"—for which the firm are wholesale trade distributors. These reflectors are manufactured in four types, scientifically designed, adapted for various classes of installation. For example, pure white glassware is described as particularly suitable for domestic, shop and office use; other classes are: vitreous enamelled steel reflectors, aluminium reflectors, and glass mirror reflectors. In addition to the purely direct reflector of the concentrating and distributing type, globes, hemispheres, and reflectors of the inverted type are manufactured, and the range is complete for all standard sizes of metal-filament lamps.

Messrs. Willans & Robinson, Ltd., Rugby.—Pamphlet No. 4 contains a description of the Willans rotary air-pump system (Muller-Josse patent) to which reference is made in our "New Devices" section to-day.

Messrs. Hann & Ingle, 13, Albert Place, Bridge Street, Manchester.—Folder card giving brief notes concerning, and prices of, the "Adaptable" earthing and continuity clip.

The British Westinghouse Electric and Manufacturing Co., Ltd., Trafford Park, Manchester.—New folder (envelope series No. 4,043), 12 pages, entitled "Industrial Motor Applications," giving small half-tone views showing bakery machinery, blouse making, woodworking, laundry, flour mill, and other industrial premises that have been electrified, and giving brief information respecting each class of application.

Messrs. Ronald Trist & Co., Ltd., 4, Lloyd's Avenue, London, E.C.—40-page pamphlet containing excellent illustrations in colour, together with description, of their "Thermofeed" regulator, the patents for which are being worked in nine other countries besides Great Britain, and a considerable trade has been already established. We understand that as a result of severe trials, clients throughout this country have placed orders for 20, and in some cases 50, machines—one for each boiler. A coloured folder clearly shows the construction and details of the regulator.

Messrs. Matthews & Yates, Ltd., Cyclone Works, Swinton, near Manchester.—Eight-page pamphlet (No. 51) giving illustrated information respecting their "Cyclone" electric blower and exhauster, electric fan, "Cyclone" motor, and the "Sirius" oxy-acetylene welding and cutting plant.

The Power Plant Co., Ltd., West Drayton, Middlesex.—16-page list (No. 8) containing illustrated description and prices of their electric hand-drilling, tapping and reamering machines.

Messrs. De Rusett Bros., 4, Page Street, Westminster, S.W.—Illustrated price leaflet of direct-coupled electric lighting sets, paraffin and petrol respectively, also direct-coupled motor pumping sets.

The British Anti-Vibration and Noise Co., Ltd., 5, Lloyd's Avenue, London, E.C.—Illustrated circular respecting their patent isolating devices and materials for preventing transmission of noise and vibration with motors, motor-generators and other electrical and general machinery. The firm have at present in hand the isolation of Diesel engines amounting to 3,000 B.H.P., with "Bavanite" iron-framed cork foundation plates.

Simplex Conduits, Ltd., Garrison Lane, Birmingham.—New list of machines for continuous current, of which considerable stocks up to 8½ KW. are kept at the company's Birmingham works. The catalogue deals also with motor-generators for cinematograph purposes, &c., and vertical motors. Quotations will also be given for D.C. generators up to 1,000 KW., of which examples are illustrated in the list. The motors can all be supplied either semi-enclosed, enclosed ventilated, or totally enclosed, with ring lubrication and specially prepared Brush bearing. All four-pole machines are of the interpole type, and each part is standardised, so as to be rapidly replaceable. The machines are of the latest design, in accordance with the specification issued by the British Engineering Standards Committee. Copies of the list can be had on application to the motor department.

Messrs. Woolnough, Lang, Ltd., St. Stephen's Engineering Works, Norwich (temporary London offices, 133, Finchley Road, N.W.).—Price list of semi-enclosed and totally-enclosed continuous current dynamos and motors of from $\frac{1}{10}$ to 14 H.P.; prices of a special large type of machine, from 15 to 60 H.P., are also quoted.

Messrs. E. Brook, Ltd., Colne Road, Huddersfield.—Sixteen-page pamphlet, entitled "Have Electric Motors been applied to my Trade?" It contains a lengthy list of names of firms, classified as to different trades, who have adopted motor-driving in Huddersfield and district. Messrs. Brook have themselves fixed all these motors. The number and H.P. of motors, and the purposes to which they are put, are indicated in a number of cases. The firm have specialised in making electric motors suitable for textile machinery, and for that class of work they have sent motors to all parts of England, and even abroad where the competition for this class of motor is very keen. In one case in this country they have placed 73 motors, giving a total of 1,400 H.P.; a number of competitors were invited to send motors to run different types of machines, and it is stated that the motor most suitable for the work was selected irrespective of price.

The Jandus Arc Lamp and Electric Co., Ltd., Hartham Road, Holloway, London, N.—Copy of the 29th edition of their catalogue of Jandus arc lamps. By thumb index reference is facilitated to the various sections which contain very full information, together with half-tone illustrations, line diagrams of interiors, and prices, relating to the following:—Regenerative lamps, special regenerative lamps, ordinary enclosed lamps, resistances, chokers and transformers, cut-outs, carbons, globes and spare parts, photo-printing lamps, colour-matching lamps ("Dalite") with list of users, the Jandus patent winch, and a list of places where the Jandus regenerative lamps are in service for street, industrial, theatre and other lighting.

Messrs. Electrical Installations, Ltd., 27 and 28, Martin's Lane, Cannon Street, London, E.C.—Attractive 28-page booklet, entitled "Electrical Service," containing brief notes relating to the usefulness, &c., of electricity in the home, the country house, the office, the factory, and the retail shop. Notes on the upkeep of installations, and particulars of the firm's "Maintenance department" are included.

Messrs. A. Reyrolle & Co., Ltd., Hebburn-on-Tyne.—A collection of a number of the firm's latest illustrated pamphlets. They deal with overload protection, telephone cable dividing boxes, Merz-Price protective gear, explosion-proof oil switches, sheet-steel panels up to 3,000 volts, plug boxes, enclosed H.T. tubular fuses, flat-back switchgear, ironclad switchgear (draw-out type), and armoured switchgear.

The Adams British Oil Co., Ltd., Plough Bridge, Deptford, London, S.E.—Leaflets concerning their "Velos" motor-car oil and motor lubricants.

The Radium Electric Co., 82, Hatton Garden, London, E.C.—Thirty-two-page illustrated catalogue, with full tabulated particulars as to prices, weights, measurements, &c., of various "Inventa" electric heating and cooking apparatus. Technical details and descriptive information lead on to particulars of electric laundry irons, electric iron for hat makers, flat-iron stand, hot plates (small and large), table heaters, nickel-plated electric geyser, bed warmers, foot warmers, and an electric poultice for supplying warmth uniformly to a part of the body.

**Train-Lighting Systems.**—Referring to our description of the Vickers system in a recent issue, Messrs. A. P. Lundberg and Sons point out that in main-line trains it is essential to provide means for dimming the lights in any compartment when it is desired to sleep, or when a compartment is unoccupied; and it is also essential to leave the turning on or off of the current to the guard, to prevent any waste during daylight, and the total extinction of light in any compartment during the night. The lamps in a compartment may number two or more, according to the ideas of those responsible, the lamps being well separated to secure good diffusion; and Messrs. Lundberg have designed series-parallel

switches for either 2, 3, 4, or 5 lamps. These switches put the lamps in parallel for full light and in series for dim light, but they have no off position, the turning off or on of the current being effected by a main switch in the guard's van. They have also a switch which will give two degrees of dim light when three lamps are in use, and one or two special arrangements.

**Book Notices.**—"*Transactions* of the North-East Coast Institution of Engineers and Shipbuilders." Vol. XXIX, Part 7. September, 1913. Newcastle-on-Tyne: The Institution. Price 5s.

"*Proceedings* of the American Institute of Electrical Engineers." Vol. XXXII, No. 9. September, 1913. New York: The Institute. Price $1.00.

"*Journal* of the Franklin Institute" CLXXVI, No. 3. September, 1913. Philadelphia, Pa.: The Institute. Price 50 cents.

"New Calorimetric Resistance Thermometers." By H. C. Dickinson and E. F. Mueller. "Note on Cold-Junction Connections for Thermocouples." By P. D. Foote. 1913. Washington: Government Printing Office.

"*Bulletin* de la Société Internationale des Electriciens." Vol. III, No. 28. August-October, 1913. Paris: Gauthier-Villars. Price 5 fr.

**"Elasta" Lamp Tests.**—MESSRS. POPE'S ELECTRIC LAMP CO., LTD., of Willesden, inform us that a number of metal-filament lamps of their "Elasta" wire type, taken at random from stock, were recently tested by an important Corporation. The lamps were burnt for a period of 2,512 hours, at the end of which time all were intact, and giving an average C.P. of 41·79 British, with an average consumption of 1·5 watts per British C.P., showing a very satisfactory maintenance of candle-power and low rate of consumption. Messrs. Pope also inform us that they have contracts from the Admiralty, H.M. Office of Works, and many large Corporations for the supply of "Elasta" wire lamps, which are now being widely used by supply companies and Corporations for street lighting purposes.

**Canada.**—It is reported from St. John's, Quebec, that the HART ACCUMULATOR CO., LTD., of Stratford, London, has decided to establish accumulator manufacturing works in that city, with the view of supplying the Canadian demand.

## LIGHTING and POWER NOTES.

**Acton.**—The U.D.C., on the advice of the clerk, has decided to procure a certificate from a qualified electrical engineer as to the condition of the electric service at the public baths.

**Airdrie.**—An exhibition of electrical appliances for domestic and business uses promoted by the Coatbridge and Airdrie Electric Supply Co., Ltd., was largely patronised. The appliances were the manufactures of the Carron Co.

**Atherton.**—Following upon the discovery of a fault on the high-tension cable in Tyldesley Road, which led to the cutting-off of the supply to the Hindsford section, it has been decided to erect two section pillars on this length of main, so that if a fault occurs in future the mains can be split up, and better facilities afforded for localising the trouble.

**Australia.**—The Albury (N.S.W.) Municipal Council has accepted the offer of the Commonwealth Bank to advance £10,500 for an electric lighting and power scheme. The loan has been made at 1½ per cent., repayable by annual instalments of £645.

In the South Australian Legislative Assembly the Premier, Mr. A. H. Peake, promised to appoint a Royal Commission to consider the municipalisation or nationalisation of the electric light and gas services.—*Australian Mining Standard.*

**Aylesbury.**—The U.D.C. has appointed Messrs. Kincaid, Waller, Manville & Dawson as consulting engineers in connection with the proposed electric light and power undertaking.

**Bacup.**—On Wednesday, Mr. H. R. Hooper conducted an L.G.B. inquiry into an application of the Corporation for sanction to borrow £1,800 for a high-tension main, in accordance with the recommendation of the Electricity and Tramways Committee.

**Bolton.**—Mr. Alfred Pilling, elective auditor, in his report just published, says the net profit in the electricity department amounts only to £1,615, and permits of a contribution to rates of £1,500, as against £3,250 in the previous year. The very heavy capital outlay on the new station now in course of erection will, for a little time, adversely affect the accounts, as the interest charges will be increased. The Committee will have an anxious period during this time of extension, and would probably much prefer, as a matter of financial prudence, to be relieved of any call for rate relief. Practically one-third of the original capital outlay has been redeemed altogether. "In my view," adds Mr. Pilling, "the electricity department could not properly spare this year the £1,500 granted in aid of rates, nor, indeed, any contribution."

**Calverley.**—Several new electricity mains are to be laid in the Calverley district by the Electrical Distribution of Yorkshire, Ltd.

**Canada.**—The city of Charlottetown, Prince Edward Island (the smallest of the Canadian provinces) is going in for municipally-owned lighting service. With this end in view the Council is at present negotiating with the Electric Light and Power Co., which controls the light and power in the city, for its purchase by the city.

A correspondent writes:—"The Ontario Hydro-Electric Commission are well-intentioned and earnest in their efforts to give the people of Ontario cheap power from the great source of Niagara. So far only the manufacturers of a few of the larger towns get this advantage. The Government has spent thus far between five and seven million dollars on the hydro-electric plant transmission lines, &c., while only the towns of London, Hamilton, Toronto, Windsor and a few smaller towns benefit. All the rest of the provinces get no benefit at all. It is found that the small manufacturing towns in Ontario not served by the Hydro-Electric cannot compete with the towns that are so served, and that they are losing their manufactures and 25 to 50 per cent. of their population as a result. It is an unfortunate position for the province to be placed in. The town of London shows a profit of $40,000 in the operation of its hydro-electric plant, and is taking steps to make a big reduction in the price of energy to city consumers. This is another case of a successfully-operated municipal plant."

"Ottawa will make a further reduction in its price for lighting this coming year. Notwithstanding the big reduction made in the price of energy to consumers last year, there will be a good profit on the year's operations, and to meet increased demands 1,500 H.P. has been obtained by the city. The city is now beginning to make preparations for supplying extra current for cooking instead of the use of gas as is now general in the warmer months. Gas costs in Ottawa $1·00 per 1,000 cb. ft. This is 30 per cent. dearer than in Toronto, and the city has under consideration the starting of a municipal gas plant. Mayor Ellis, the father and the chief manager of the electric plant, proposes to use the electric current instead of gas, and announces that they can easily compete with gas at $1, even now. He proposes to supply consumers with electric cooking apparatus on low monthy instalments and supply the energy at a price that will make cooking in Ottawa by electricity cheaper than gas. This will be a splendid move, and Ottawa will be the first city in Canada to make cooking by electricity general, instead of by gas as now obtains."

**Chester.**—The construction of the new hydro-electric works of the Chester Corporation on the site of the old Dee Mills is now completed, and the machinery has been tested with satisfactory results. The formal opening of the works will take place in the course of a few weeks.

**Cleethorpes.**—A number of the better working-class houses are being wired for supply as they are built, and shilling-in-the-slot meters are being installed. The Council has decided in these cases to supply the first lamps to the houses free of charge.

**Dover.**—The T.C. has decided to have the E.L. installed at Barton Road schools in place of gas.

**Dromore (County Down).**—The new electric lighting scheme has just been most successfully inaugurated in this town. It may be remembered that the Board of Works refused to sanction a loan for the purpose, so the scheme was carried out by a private company.

**Erith.**—The U.D.C. on September 15th discussed a recommendation by the Electricity Committee that the Council should again provide sundry electrical fittings for consumers, some of which, it was asserted, it was impossible to obtain locally. Councillor Mathers moved that it be referred back to the Committee to see if it was not possible for local traders to supply the necessary articles. Mr. Palmer, in seconding, said that the local traders had been negligent in not providing the appliances required, but they should be given another chance to do so, as the Council did not want to recommence competition with them. Mr. Ling observed that if they supplied lamps he did not see why they should not supply other electrical appliances. It was explained that often a little switch was required by a consumer, and could not be obtained from local tradesmen for two days, whereas the Council's men could put the matter right in about two minutes. Another difficulty was that often consumers did not know what they wanted themselves, and the men in the shops could not always advise them, and all this tended to make the public think that the electric light was hardly worth having. On a division, the matter was referred back to the Committee.

**Godstone (Surrey).**—Owing to the heavy cost of gas (over £300 per annum), the B. of G. has appointed a committee to consider the desirability of adopting another form of lighting at the Workhouse.

**Greenock.**—Mr. F. S. Grogan has been giving demonstrations and lectures on electric cooking at the Town Hall, from Wednesday until to-day inclusive, under the auspices of the Corporation electricity department.

**Helsby (Cheshire).**—The Parochial Committee has decided to apply to the L.G.B. for sanction to borrow £1,000 for sewer extensions and conversion to electrical power at the water and sewage works.

**Heston-Isleworth.**—At last week's meeting of Brentford Union Board of Guardians, a letter was read from the electrical engineer to the Heston and Isleworth U.D.C., respecting the proposed lighting of the Workhouse buildings with electricity. He suggested the lighting of the board-room first; that would cost for installation £28, and the rest of the premises £108. It was recommended that the Board take the supply on the telephone system, and a quotation was given at £27 17s. per annum for 1,700 units. The clerk said the present cost of gas lighting for the board-room was £11 12s. 6d. Dr. Williams pointed out that many Boards of Guardians generated their own electricity, at a cost of about ½d. per unit, and he did not see why they could not do the same. Several other members objecting to the high price quoted, the Board referred the matter to the Engineering Committee.

**Heywood.**—The Bury T.C. recently decided to enter into an agreement with the Heywood Corporation for a supply of energy in bulk to Heywood, but the Lancashire Electric Power Co. has refused to give its consent to the agreement. The Town Clerk last week reported to the Bury Electricity Committee that in accordance with the instructions of the Council he had made application to the B. of T. for an order dispensing with the company's consent.

**India.**—Simla.—The engineer in charge of the electricity department of the Simla Municipality has been instructed to submit detailed proposals, with estimates, for the extension of the electrical power house plant, sub-station equipment and mains. —*Indian Engineering.*

**Leyton.**—Last week Mr. P. M. Crosthwaite held a L.G.B. inquiry into the application of the U.D.C. for a loan of £5,600 for electricity purposes—services and mains. There was no opposition.

**Littleborough.** — The price of energy for lighting purposes is to be reduced from 5d. to 4½d. from October 1st.

At a special meeting of the D.C. last week plans and estimates for extensions of cables and other work amounting to £2,000 were approved. It was decided to increase the amount to £4,000 to provide for future mains and service cables and additional transformers, and to apply for sanction to borrow this sum. Mr. Hawtayne, consulting engineer, was instructed to proceed at once with the laying of the four-core cable from Victoria Street to Joseph Street.

**London.**—Battersea.—Electricity mains are to be extended in various parts of the borough at a cost of £298. At the last meeting of the Borough Council the Law and General Purposes Committee submitted a report upon the arbitration proceedings instituted by the Board of Trade to settle the differences between the Council and the London Electric Supply Co., Ltd., as to the route, &c., which should be taken by the company in laying their mains through the borough. At an early stage of the hearing, the Committee stated, the question was raised by the company as to whether the Council was bound by the terminal boundary points already settled with the adjoining boroughs, and would, therefore, have to submit an alternative route between those points. The engineer of the company also stated that the company had revised their proposals, and desired to lay four pipes only instead of eight, and were prepared also to put them vertically where necessary or advisable. At a later stage the Council's engineer suggested that an adjournment should be made for consultation between himself and the borough surveyor and the electrical engineer. As a result of this consultation, a proposal was tentatively agreed to for submission to the Council for approval, and the arbitration was then adjourned until September 30th, in order that the decision of the Council might be obtained. The proposal mentioned is (1) that the Council agree to a certain route starting along the north side of York Road, to the eastern end of the borough; and (2) the company to pay the cost of trial holes made by the Council, the other costs of the Council in connection with the arbitration, and the Arbitrator's costs. Under the circumstances the Committee recommended the Council to agree to the route suggested on the terms referred to.

Hammersmith.—The Council has agreed to an application from Messrs. J. Lyons & Co., Ltd., for the supply of electricity to their premises, 2, Hammersmith Road, for a period of five years at 1d. per unit.

Mains are to be extended to Aldensley Road at a cost of £177.

**Long Eaton.**—The U.D.C. has received from the L.G.B. sanction to loans of £4,407 for generating plant, £2,701 for a boiler and economiser, and £2,741 for extensions to the electricity works buildings.

**Luton.** — The L.G.B. has sanctioned the borrowing of the following amounts for the purposes of the undertaking:—£8,800, repayable in 25 years, for new buildings; £24,000, repayable in 15 years, for new plant, and £5,000, repayable in 25 years, for mains

**Macroom (Co. Cork).** — At a meeting of the Urban Council, the chairman, Mr. John O'Shea, drew attention to the unsatisfactory public lighting of the town by electricity. For two or three weeks past the lighting had been practically useless. It would be well, however, that the private consumers should know that a new engine was being laid down with a view to supplying the town with a good and reliable service. The clerk said that Mr. Smith proposed to expend £1,000 in improving the electric lighting of the town, and in providing improved and reliable plant for the purpose. The chairman said that the engine was ordered, and would soon be erected. They would not, therefore, be any longer dependent on the water power as they were at present, and they would in the future have better lighting.

**Manchester.**—The electrical workers employed by the local contractors have decided to give a month's notice unless their demand for an advance of 1d. per hour is granted.

Levenshulme.—St. Peter's new schools are to be lighted by electricity.

**Market Weighton.**—Mr. C. H. Best and Mr. Charles Pullan, of Bradford, propose forming a company with a capital of £2,000 for the purpose of supplying electric current for lighting and power at Market Weighton, where gas is 5s. per 1,000 cb. ft., and, with this end in view, have persuaded the Market Weighton and Arras Parish Council to meet them to discuss matters.

**Mexborough.**—Last week the E.L. Committee spent five hours in investigating complaints presented by the electrical engineer (Mr. John Senior) against a wireman jointer named Harold Kemp. The matter was referred to the Council meeting held the following evening, when the Council sat with closed doors until midnight and heard the statements of both parties concerned and other witnesses. At the end of the consideration a very sharp division of opinion was indicated, the voting being seven to six, and, as two members of the Council were absent, it is probable that the matter will be further discussed.

**Middlesbrough.**—A report on the system of charging for electricity was submitted to the Gas and Electricity Committee by the electrical engineer, Mr. H. M. Taylor. He favoured separate charges for lighting, and for cooking, heating and power. He did not think the system based on the rateable value could be worked satisfactorily. He favoured a charge of 1d. per unit for heating purposes only. The Committee, after discussion, decided to reduce the charge per unit for domestic purposes from 2d. to 1d.

**Morley.**—The annual financial statement of the Corporation electricity department shows that though there is a deficit of £619 on the year's working, this is £164 better than the previous year. The revenue showed an increase of £401, and, together with sundry receipts, amounted to £3,476. The expenditure amounted to £2,152. There was a gross profit of £1,325 on the year's working, but a deficit was caused by the payment of £839 interest on loans, and £1,105 to the sinking fund. The number of units generated at the station was 242,637, of which 41,394 were supplied for the public lamps, and 138,692 were sold to private consumers by meter at 6d. per unit.

**Newport (Mon.).**—Mains are to be extended to Friars Road and Brynglas Road, at a cost of £328.

**New Zealand.**—We read in the *Australian Mining Standard* that a wiring scheme is proposed by the Christchurch (N.Z.) City Council, and is embodied in the Christchurch Electrical Supply Empowering Bill, which passed its second reading at the end of July. The Bill is to authorise the Council to expend £30,000 in the form of loans to ratepayers who desire to have electrical installations in their dwellings. The Council has already been authorised by the ratepayers to borrow £120,000 for carrying out the Lake Coleridge scheme for the generation of electrical energy, and desires to obtain the sanction of Parliament to apply a small portion of that loan to encourage ratepayers to use their own power by advancing the amounts necessary to procure its installation, the money so advanced to be repaid in five years. It was stated by Mr. T. W. Davey, when moving the second reading in the House of Representatives, that whereas gas companies were in the habit of monopolising gas fitting, the City Council had no intention of monopolising electrical installation work, and the opposition which contractors in Auckland and Wellington had shown to the Bill was based on an entire misapprehension of its purpose and scope. "If the contractors," he said, "only knew on which side their bread was buttered, they would support the Bill, because it ensured that when their contract was completed they would get their cheque from the Council."

**Nuneaton.**—The T.C. has resolved to have 25 existing gas lamps converted to electric lamps.

**Portsmouth.**—The E.L. Committee is extending its mains in a number of streets.

**Preston.**—Mr. Gibbs, electrical engineer, in a report to the Guardians upon the disposal of the large engines for generating electricity at Fulwood Workhouse, stated that the maximum current the Board was ever likely to require at any time was 250 amperes, which would include the charging current of the battery. He recommended the installation of another engine and dynamo of 250 amperes capacity, together with the retention of the present small engine. This would allow the Board to dispose of the two big engines, which would leave a balance in the Guardians' favour, after payments for alterations in the foundations. The Board deferred consideration of the matter.

The Corporation Estate Committee has consented to the R.D.C. carrying an overhead wire on poles, about 20 ft. high, across the Ribble and Holme—until the new bridge is completed, when it will be laid underground—for the purpose of obtaining electric power to pump the sewage of Middleforth.

**Rawtenstall (Lancs.).**—At a meeting of the T.C. on September 18th, Councillor Parkinson asked for consideration to be given to the question of lighting the whole of the roads in the

borough by electricity. Councillor Trickett replied that the matter would be considered in due course.

The Lighting Committee has given instructions to the electrical engineer and tramways engineer and the lighting superintendent with regard to the lighting by electricity of Bury Road and of Hall Carr Road.

**Rochester.**—By arrangement with the T.C. the E.L. Co. is making an experiment in lighting the High Street with electricity by means of four 100-c.p. lamps suspended from wires fixed to the tramway poles.

**Rothesay.**—The scheme drawn up by Mr. J. A. Robertson, of Greenock, for an electric light and power scheme and refuse destructor was considered last week by the Rothesay T.C., and after three hours' discussion was adjourned for further consideration. Mr. Robertson says that by adopting a destructor there would be a saving as compared with the present method of refuse disposal.

**Salford.**—Annual Accounts.—The borough treasurer's report states that the electricity department was not able to show a profit after £4,618 had been paid to the depreciation and renewals fund. This was £7,000 worse than the previous year's trading. There was an increase in the cost of generation, distribution, &c., including replacement of machinery after the disastrous fire, of £17,160. In respect of the fire, £11,330 was received from insurance companies. The tramways department showed a net surplus of £22,000, which was £4,000 better than the previous year. There was an increase in traffic receipts of £6,403, whilst several other factors contributed to the improved position of the undertaking. On the other hand, the traffic and general expenses increased by £7,312, and £2,240 was expended on covered tops for bogie cars.

**South Africa.**—Cape Town.—The City Council has decided to lay additional cables from the Dock Road power station to the Molteno power station. The estimated cost of these cables is £5,000. Tappings from the cables will be carried to the Mount Nelson Hotel, and they will also be used eventually in connection with the Table Mountain Railway, and the anticipated bulk supply to the United Tobacco Factories.

Worcester (Cape Province).—The Municipal Council has decided to entrust a scheme for the supply of electric light and power to Mr. Thomas Stewart, engineer, Cape Town. The arrangement is that an electrical engineer, whose name and qualifications must first be approved by the Council, shall work in conjunction with Mr. Stewart. The prime movers in the installation will most probably be water turbines.

**Southampton.**—A L.G.B. inquiry is to be held into the Council's application to borrow £16,720 for the electricity undertaking, and £4,400 for a refuse destructor.

**Steyning (Sussex).**—Mr. C. B. Oxley, of St. John's, Fletcher's Croft, Steyning, has announced his intention to apply to the B. of T. for a prov. order for electric light at Steyning, Bramber and Upper Beeding.

**Stirling.**—At a meeting of the Corporation a further letter was read from Mr. G. Balfour, of Messrs. Balfour, Beatty and Co., London, regarding his proposals for the electrification of the tramways. Mr. Balfour wrote that he assumed that the particulars of his scheme which were of the greatest importance at the present moment were those relating to his proposal to acquire Stirling burgh electricity undertaking. He said he was prepared to pay £28,642 to cover the unredeemed debt on the undertaking, an additional sum of £2,250 to refund the Council the difference in accumulated debit balances, accumulated up to the year 1908, and the credit balances carried to reserve since that date; and, in addition, a sum in cash of £2,000, making a total of £32,892. Mr Balfour said he appreciated the objections of the Council to holding the cash amount of the unredeemed debt on the undertaking as an investment until redemption became due under the existing arrangement, and he had, therefore, added to the amount of unredeemed debt the cash amounts totalling £4,250. He also promised a reduction in the charges for energy. As far as he could calculate on the figures at his disposal, the aggregate value of all reductions would amount to between £800 and £900 per annum. Mr. Balfour also stated that the costs incidental to the transfer would be borne by him. The letter was remitted to the Tramways Committee to report.

**Swansea.**—Annual Accounts.—The accounts of the electricity department issued by Mr. Prusmann, the electrical engineer, show that the capital expenditure is £190,272, of which £43,379 has been repaid. The revenue amounts to £29,112, an increase of 1·73 per cent. Total costs were £16,588, and the gross profit £12,537, while the net profit on the year's working was £2,133. The total units sold were 3,127,229, or 15·17 per 32-watt lamp. The average price obtained was 2·16d. Works costs were £12,257, or ·94d. per unit sold, an increase of 9·04 per cent. Management expenses, salaries, &c., totalled £16,588, or 1·273d. per unit sold.

**Tadcaster.**—The electric power cable in Lock Lane is to be extended to the new sewage works.

**Tonge (near Bolton).**—The new Sunday school for St. Chad's, in Belvoir Street, will be lighted by electricity.

**Tunbridge Wells.**—Thirty-five gas lamps in the town are to be converted from gas to electricity. The B. of T. has forwarded a formal order permitting the Corporation to supply energy to several places outside the borough boundary. The question of applying for a provisional order extending the area of supply is under consideration.

**Tyldesley.**—To celebrate the inauguration of the electric supply to Tyldesley, the Lancashire Electric Power Co. entertained 40 guests representative of various local bodies at dinner on September 18th. Mr. F. Isherwood said the local Electric Lighting Order was obtained in 1902, and in 1904 the Council was advised to take a supply of electricity from an outside source. Later the order was transferred to the Lancashire Electric Power Co., under an agreement which gave the local authority power to take it over again at the end of 7, 14, 21 or 28 years. Regarding the matter as a business proposition, he thought that the Council had acted wisely.

**Warrington.**—A scheme of extensions in connection with the electricity undertaking, involving an expenditure of £16,000, has been considered and approved by the Electricity and Tramways Committee. The extensions are rendered necessary owing to the ever-increasing demand for power. The proposal includes the provision of a 2,000-kw. turbo-alternator and a water-tube boiler of about 4,500 sq. ft. heating surface.

**Witney.**—The new plant at the generating station is completed and ready for preliminary running and tests by the makers.

## TRAMWAY and RAILWAY NOTES.

**Australia.**—Mr. Justice Burnside recently delivered the award of the West Australian Arbitration Court in the dispute between the Kalgoorlie Electric Tramways, Ltd., and its employés. The award fixes the minimum wage of drivers at 11s. a day, 48 hours to constitute a week's work, but the company may employ drivers and conductors 54 hours per week, exclusive of Sunday, at ordinary rates. After nine hours in one day, or 54 hours in a week, overtime is to be paid at the rate of time and a quarter. Sunday work is to be paid at time and a half, but if the company is compelled, by agreement with the municipal councils, to maintain a Sunday service, the ordinary rate is to prevail. Drivers and conductors are to be granted seven days' holiday annually on full pay. —*Australian Mining Standard.*

Sydney (N.S.W.).—From the report of the Chief Commissioner on the working of the tramways for the year ended June 30th, it appears that during the year tramway extensions totalling 12 miles 14 chains were opened for traffic, making the line mileage 207¾, while a number of new lines are under construction and further extensions are contemplated. Good progress has been made with the erection of the new tramway power house at White Bay, Balmain, and a portion of the plant has been erected on permanent foundations, and is now under steam. The total staff employed in connection with railways and tramways on June 30th numbered 41,322, as compared with 37,605 in the previous year, an increase of 3,717.—*Financier.*

**Argentina.**—In 1905 the City Council granted a concession to Messrs. Varela & Cuneo for an electric tramway in the Federal capital to join up with one to the Tigre. The concession was transferred to the Buenos Ayres City and Suburban Tramways Co., which was connected with the Buenos Ayres Port and City Tramways Co. As the period allowed by the contract has expired, and the work has not been commenced, the Mayor has imposed a fine of $1,000.

The San Juan Legislature has approved a Bill granting a concession to Mr. Eugenio Vargas for the construction of electric tramways in that city.—*Review of the River Plate.*

**Belfast.**—At the fortnightly meeting of the Tramways Committee on Monday, the surcharge of the bonus paid to the employés was reported, and the members concerned decided to appeal to the Local Government Board to have the surcharge—which amounts to over £2,000—rescinded. The National Amalgamated Union of Labour asked to have the wages of the employés increased by ½d. per hour in lieu of the surcharged bonus. The matter was deferred.

**Bolton.**—In his annual report, Mr. A. Pilling, electric auditor, says the traffic revenue has increased in a remarkable manner. With the same average number of cars in use per day as in the previous year, the receipts have increased by £3,994. The department has a disposable profit of £16,436, an increase of £6,584.

**Canada.**—Nelson, B.C.—It is officially announced that arrangements are about completed for ordering four electric locomotives at an approximate cost of $75,000 each, to be used on the Castlegar to Rossland line of the Canadian Pacific Railway, which is to be electrified shortly. Already the West Kootenay Power and Light Co. has made arrangements to increase the capacity of its power plant at Bonnington Falls, and the necessary machinery is being ordered; 9,000 h.p. is being added to the plant. The completion of the electrification of this route is expected to overcome the difficulties now experienced on the heavy grades on the Rossland hill, and a material reduction will be made in the time of the run from Castlegar to Rossland.—*Canadian Engineer.*

**Chadderton.**—The U.D.C. has instructed its Parliamentary agents to seek powers on its behalf for the running of motor-omnibuses in the district.

**Croydon.**—The B.C., on Monday, upon the recommendation of the Tramways Committee, passed a resolution urging the Government speedily to legislate upon the lines of the recommendations of the Motor Traffic Select Committee, owing to the dangerous and congested state of the streets of Croydon, the serious accidents and loss of life, through the influx of motor-'buses. Five persons have been killed in the streets of Croydon this year by these vehicles, but none by tramcars.

**Dearne Valley.**—The Urban District Councils of Bolton, Wath, Thurnscoe and Wombwell, in the Dearne Valley of Yorkshire, have decided to promote a Bill in Parliament granting the Councils power to undertake a tramway scheme for the linking-up of the various districts under their control.

**Edinburgh.** — A number of proposals for tramway extension are before the Council's Tramway Committee. At last week's meeting, it was moved that the Committee consider the advisability of promoting a provisional order for the extension of the tramways to Redford Barracks and the Dreghorn district. The proposal is to extend the Colinton Road tramways, so as to form a circular route linking up the City Fever Hospital and the poor-house with Morningside. The burgh engineer was instructed to prepare a plan of the proposed route. The town clerk was asked to bring a previous report regarding extensions beyond the city bounds up-to-date, while a sub-Committee was instructed to consult with the tramway company on the subject of extension to Corstorphine.

**Glasgow.**—The T.C., after negotiation, has arranged with the Caledonian Railway Co. in connection with expenses incurred by the re-erection of bridges at certain points to carry the tramway lines over the railway system. The work, it appeared from the Corporation minutes, was largely departmental, three T.C. departments and the company being involved, while the amount rendered against the latter was £5,207. The Corporation Committee in charge has decided to accept the offer of the company of £3,000 in full settlement of the accounts, the sum to be allocated as follows—viz., £251 to the gas department, £406 to the electricity department and the balance of £2,343 to the tramways department.

**Leith.** — The T.C. Tramways Committee is asking for a conference with Edinburgh Town Council, regarding the proposed extension of Leith tramways eastwards from Seafield terminus.

**Manchester.**—On Tuesday a deputation of tramway workers waited on the Workmen's Committee of the Manchester Corporation and pressed a claim for an extra day's holiday in consideration of the exceptional nature of their employment. It will be remembered that the Tramways Committee conceded the men's claim for seven days' holiday per annum with pay, instead of six days as at present, but the Workmen's Committee rejected the application but consented to receive a deputation. The Committee has now decided to recommend the Council, having regard to the exceptional circumstances under which they are employed, to give tramcar drivers, guards and trolley boys the extra day's holiday per annum, with pay.

**Newcastle.**—The question of extending the tramways to Benton has been under discussion by the City Tramways Committee and the Benton D.C. A further consultation may be held at an early date.

**Northampton.**—The B. of T. has sanctioned the extension of the Corporation tramways to Far Cotton. The scheme has been delayed for the widening of the South Bridge, which has now been completed, and the metals on this part of the road have already been laid.

**Preston.**—The Corporation Tramways Committee has had before it an application signed by drivers and conductors, asking it again to consider the advisability of covering in the ends of cars. The Committee has deferred consideration, and instructed the engineer to report after inspection of the Leeds cars. It has accepted the tender of Leyland Motors, Ltd., for the supply of a motor tower wagon for the sum of £735.

**Rochdale.**—Recently the Corporation tramway employés sent in a demand for higher wages and improved working conditions, and certain concessions were granted by the Tramways Committee, which will cost £350 a year. The men were not altogether satisfied, and, as a result of a further demand, the Committee has agreed to pay time and a quarter to all the men after working 11 hours, and also consented to their reaching the maximum rate of pay in four years, instead of five.

**South Africa.**—The *Financier* quotes the Mayor of Durban as stating, while referring with satisfaction to the deferred decision of the Council with regard to a proposed important extension, that recent developments in connection with road traction appeared to him to indicate that the days of the tramway track were numbered, and that motor and electric 'buses would ere long supplant the tramcar equipment.

**Southport.**—Annual Accounts.—The report of the Borough Treasurer (Mr. Lloyd) shows that the Tramways Committee had an income of £17,314 ; working expenses were £12,492, and the gross profit £4,821. £5,224 was received from the Tramways Co. for the lines leased to them, but after charges for interest, sinking fund, and depreciation had been made, there was a deficit on the year's working of £1,651, this bringing the adverse balance on tramways account from £5,200, at which it stood on March 31st, 1912, to £6,852 on March 31st, 1913. The capital account of the Tramways Committee now stands at £196,179. The debt extinguished totals £83,260, and there was £13,238 credited to renewals fund, whilst the sinking fund available totalled £5,266. The Electricity Committee had a net profit of £1,363.

**Tottenham.**—The District Council is urging the Metropolitan Electric Tramways Co. to remove the centre poles on their system in the district.

**West Ham.**—The B. of T. has agreed to the Council's proposal to increase the maximum speed limits on the tramways.

## TELEGRAPH and TELEPHONE NOTES.

**Amateur Wireless.**—The Postmaster-General has requested all the police authorities of Great Britain to assist in the prevention of unofficial and unauthorised wireless telegraphy, especially with portable wireless apparatus.

**Berlin-Rome Telephone.**—The trans-Alpine telephone from Berlin to Rome, *via* Berne and Milan, is approaching completion. This international line, which passes through the Simplon Tunnel, is the longest on the Continent as a "through" line between capitals. In several sections it passes over Swiss mountains, and precautions have been taken to prevent avalanches sweeping it away in winter. Most of the cost is guaranteed by Germany and Italy.—*Standard.*

**Canada.**—The Department of Marine and Fisheries is going to erect a wireless telegraph station near Fort Henry for the purpose of forming a connecting link between Montreal on the east and Toronto on the west, in a chain of stations reaching across Canada from Labrador to Vancouver.

**Isle of Man.**—Thanks to the intervention of the Lieutenant-Governor, the cessation of the telephone service at Douglas threatened by the Post Office has been averted, and the authorities are making arrangements to continue the service to the notified subscribers.

**Morocco.**—The Committee for Foreign Affairs of the French Chamber of Deputies recommends an expenditure for postal, telegraph and telephone services of £428,000.—*Board of Trade Journal.*

**Postal Servants.**—The Post Office has issued a statement in reply to the resolutions passed at local meetings of the postal employés condemning the Holt Committee's report, showing that, in addition to the advantages of security of tenure, prospect of a pension, holidays (on full pay), &c., the postal service compares favourably with similar outside employments in point of wages. Telegraphists in the large provincial towns will receive 44s. a week after 10 years' service, with a maximum of 58s. ; in the smallest towns 39s. and 42s., for 45 hours' work, representing in each case a rise of 2s. a week in the maximum wages. Very considerable concessions have been made to the engineering classes, the number of established employés being increased by 35 per cent. and the hours of duty in minor grades being reduced from 50½ to 48 a week. Unestablished skilled workmen will receive increases up to 2s. 6d. a week and labourers up to 2s. 9d. The net cost of the Committee's recommendations will exceed a million sterling per annum.

The National Joint Committee of the Postal Organisation, by way of rejoinder, states that the extra expenditure named will not be reached for at least 10 years, and that most of the London employés get little or no increase.

**Train Control.** — A wireless train-control system, invented by Prof. C. Wirth, of Nuremberg, has been successfully tested on the Bavarian State Railway Lines, in the presence of British railway officials.

## CONTRACTS OPEN and CLOSED.

### OPEN.

**Australia.**—Perth.—November 12th. For the P.M.G. Lamp signalling trunk line switchboard, of five sections, &c.

New South Wales.—October 15th. The Government Railways invite tenders for the supply of 13 D.C. motors, to specification No. 412. Specifications are obtainable at the Electrical Engineer's Office, 61, Hunter Street, Sydney (price 2s. 6d. each).

March 18th, 1914.—Tenders are invited by the Postmaster-General for the supply, delivery, and erection of automatic telephone switchboards, with associated equipment, at the Epping, Ryde, Hunter's Hill, Drummoyne, Wahroonga, Paddington and Waverley exchanges, New South Wales. — *Australian Mining Standard.*

Sydney.—October 15th. For the P.M.G. ; measuring instruments, telephone parts and switchboard parts. Particulars from the Commonwealth Office, 72, Victoria Street, S.W.

VICTORIA.—November 12th. For the Victorian Railways; flame arc lamps.

October 14th.—For the P.M.G. A common-battery multiple switchboard.

November 4th.—For the P.M.G. Eight automatic telephone switchboards.

November 12th.—Victoria Railway Department. State coal mines, Wonthaggi. The time for tenders for haulage engine and electrical equipment has been extended to November 12th, and a copy of specification may be seen in London (C.I. Department, Board of Trade).

November 15th.—Melbourne Suburban Railways. Overhead electrical equipment of permanent way and overhead transmission mains. See "Official Notices" September 12th.

October 15th.—20,000-volt H.T. switchgear, L.T. switchgear and accessories for the power stations and sub-stations. See "Official Notices" September 19th.

MELBOURNE.—October 1st. Lead-covered cable, for the City Council. See "Official Notices" September 19th.

October 7th.—Six 60-K.V.A. and one 30-K.V.A. single-phase transformers, for the City Council. See "Official Notices" Sept. 19th.

October 7th.—33,300 carbon-filament lamps, for the City Council. See "Official Notices" September 19th.

October 8th.—City Council. Lead-covered cable. See "Official Notices" to-day.

SOUTH AUSTRALIA.—ADELAIDE.—November 12th. Postmaster-General's Department. Lamp-signalling trunk line switchboard. See "Official Notices" to-day.

BRISBANE.—November 19th. For the P.M.G. Wire, bronze, 100 lb. per mile. See "Official Notices" to-day.

**Belgium.**—October 4th. The Fonderie Royale de Canons in Liége (80, Quai Saint Leonard) is inviting tenders for a quantity of electric cables for the forts in the Liége and Namur districts.

October 11th.—The Belgian Post and Telegraph authorities in Brussels (Salle de la Madeleine) are inviting tenders for a quantity of electric cable.

January 2nd, 1914.—Tenders are invited for the supply and erection of an iron bridge, with mechanical and electrical fittings complete. Guarantee deposit after acceptance, 10,000 fr. Cahier des Charges No. 104 (80 centimes) and drawings (1·60 fr.), on application to the Musée Commercial, 15, Rue des Augustines, Brussels.

**Canada.**—October 25th. Regina, Sask., City Commissioners. One 3,000-KW. steam turbine with condenser; one 25-ton hand power crane. Specification from Mr. E. W. Bull, Superintendent of Light and Power Department, Regina. Deposit: 5 per cent. of tender.

**Dundee.**—September 29th. (1) Construction of tramways in Blackness Road, and (2) supply of 170 tons of steel tramway rails and of manganese steel points and crossings and steel tie bars. Specifications from Mr. J. Thomson, city engineer. Deposit £2 2s. (returnable).

**France.**—October 15th and 18th. The French State Railway authorities (Bureaux du Service Electrique, 2me Division) in Paris (43, Rue de Rome) are inviting tenders until October 15th for four cables for three-phase current, 15,000 volts, 25 periods, of a section of 3 × 150 sq. mm., to connect the Moulineaux generating station in Paris on the one hand with the Viroflay sub-station, and on the other with the Porchefontaine sub-station. The same authorities are also inviting tenders until October 18th for two high-tension three-phase cables between the Moulineaux station and the Vaugirard-Marchandises sub-station.

PARIS.—October 2nd. Supply of insulators and galvanised iron wire for the postal and telegraph service in Senegal, in two lots. Particulars, Ministère des Colonies, Paris.

**Germany.**—October 11th. The Bremen Railway Construction Office, in Bremen, is inviting tenders for two 30-cwt. electrically-operated cranes.

**Holland.**—October 1st. The municipal authorities of Leeuwarden are inviting tenders for a quantity of electric cables for the electricity supply service in the town.

**Ilkley.**—October 6th. (Sec. 1) Prime-movers; (2) station equipment; (3) cables and distribution; (4) overhead travelling crane. See "Official Notices" September 12th.

**Keighley.**—October 1st. 6,600-volt 3-phase A.C. transmission line (two miles) for the Corporation. See "Official Notices" September 19th.

**Leicester.**—September 30th. (*a*) One high-pressure steam turbine, direct-coupled to one 3,000-KW. three-phase alternator, together with condensing plant, high and low-tension switchboards, rotary converters, &c.; (*b*) two water-tube boilers, together with fuel economiser, and the necessary steam, feed, blow-off and drain pipes, &c. See "Official Notices" September 5th.

October 7th.—Car repairing shops for the Corporation tramway department. Mr. E. G. Mawbey, borough engineer (returnable deposit of £2).

**London.**—BERMONDSEY.—October 23rd. Water softener and purifying plant at the Infirmary, Lower Road, Rotherhithe, S.E. Mr. E. Pitts Fenton, Clerk.

HAMMERSMITH.—Tenders are to be invited by the Electricity Committee for clearing away ashes and clinker during 12 months; and for the supply of a mechanical stoker and hard dry coal.

**Middleton.**—October 6th. Steam coal, for a year, for the Corporation electricity works. Mr. S. Pauls, electrical engineer.

**New Zealand.**—October 31st. Telephone instruments and accessories for Lake Coleridge power scheme. Specification may be seen at Board of Trade (C.I. Dept.) in London.

November 12th. Dunedin City Council. Supply of meters, demand indicators, insulated and bare wire, for two years. Specifications from Electrical Engineer, Dunedin.

December 11th.—Switchboard and accessories for Wellington Corporation E.L. Dept. Specification may be seen at Board of Trade (C.I. Dept.) in London.

Tenders are also invited for the supply of two A.C. pressure regulators for 3,000 and 400 volts. British manufacturers can obtain particulars at the B. of T. Commercial Intelligence Department.

**Rochdale.**—October 13th. Mechanical filtration work, including turbine or water motor, &c.; also electric lighting plant. Specifications, &c., from Mr. F. H. Brunt, engineer and manager, Waterworks Office, Lord Street. Deposit £3 3s.

**Salford.**—September 29th. Compound air compressor, for the electricity department. Specifications, &c., from Borough Electrical Engineer, Frederick Road, Pendleton.

September 29th.—Rotary converters for the Corporation. See "Official Notices" September 19th.

**Saxmundham (Suffolk).**—October 2nd. Sewerage and sewage disposal works, with pumping and electrical plant, dynamos, motors, cables, switches, &c., for the R.D.C. Mr. P. F. Mackenzie Richards, engineer, 53, Victoria Street, Westminster, London. (Returnable deposit of £5 5s.)

**South Africa.**—JOHANNESBURG.—November 24th. Electric light fittings for the Town Hall and Municipal Buildings. See "Official Notices" to-day.

**South Shields.**—October 15th. Corporation. One 2,000-KW. turbine, direct coupled to two three-phase generators in tandem, together with condensing plant, rotary converters, transformers and switchgear, &c. See "Official Notices" to-day.

October 25th.—Corporation. Five or ten top-covered tramcars complete. See "Official Notices" to-day.

**Spain.**—The municipal authorities of Pozoblanco (province of Cordoba) have just invited tenders for the concession for the electric lighting of the town during a period of six years.

**Walthamstow.**—October 8th. L.T. feeder cable for the Electricity Department. See "Official Notices" September 19th.

**Warrington.**—October 14th. Corporation. (1) Low-tension cable; (2) low-tension feeder panel. See "Official Notices" to-day.

**Worthing.**—September 29th. Corporation. Diesel engine and D.C. generator. See "Official Notices" September 12th.

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## CLOSED.

**Australia.**—The contract for main steam pipes and valves for power house, Canberra, Federal Territory, has been placed with Stewarts & Lloyds (Australia), Ltd., at £374.—*Australian Mining Standard.*

NEW SOUTH WALES.—P.M.G.—
Copper binders, zincs, &c.—I.-R., G.-P. & T. Works Co.
Copper tapes, tinned copper wire, &c.—B.I. & Helsby Cables, Ltd.
Copper wire.—R. Johnson, Clapham & Morris.
Tinned copper wire.—Noyes Bros.
Outside distributing wire.—W. T. Henley's T. Works Co.
2,500 cells.—R. J. Connolly.
10,000 connectors.—British G.E. Co., Ltd.
20,000 battery leads, 40,000 zincs, suspenders, &c.—Lawrence & Hanson Electrical Co.
50,000 porous pots, 20,000 tubes.—I.-R., G.-P. & T. Works Co.
Insulating tapes.—W. G. Watson & Co.
*Australasian Record.*

P.M.G.—
60,000 jointing sleeves.—Theodore Zwicker & Co.

Public Works Department.—
Electric passenger elevator (£1,415), and electric goods elevator (£800) for Parcels Post Office, Sydney.—Standard Waygood Elevator Co., Ltd.
*Tenders.*

QUEENSLAND.—P.M.G.—
Copper binders.—I.-R., G.-P. & T. Works Co.
Jointing sleeves.—Brabant & Co.
Jointing sleeves.—Theodore Zwicker & Co.
Copper wire (349 tons); bronze wire (122 tons).—G. Wills & Co., Ltd.
Five nauts of submarine telegraph cable, £141 per naut.—Siemens Bros. Dynamo Works.
Paper-insulated lead-covered cable.—Western Electric Co.
Paper-insulated lead-covered cable.—Noyes Bros.
Eight tons galvanised steel wire.—Johnson, Clapham & Morris.
22,000 glazed earthenware conduits.—Brunswick Brick, Tile and Pottery Works Proprietary.
7,000 carporous pots.—British General Electric Co., Ltd.
4,000 Callaud battery zincs.—Lawrence & Hanson Electrical Co.
1,000 Leclanché zincs.—I.-R., G.-P. & T. Works Co.
*Tenders.*

VICTORIA.—Public Works Department.—
80 electric radiators for use in various Government buildings.—Sutherland and Ashman, £118.
*Tenders.*

**Austria.**—The Austrian Siemens-Schuckert Co., of Vienna, has secured a contract from the municipal authorities of Koplitz, Bohemia, for the establishment of a central electric lighting station in the town.

**Belfast.**—The B.C. Tramways and Electricity Committee has accepted the tender of Callender's Cable and Construction Co., Ltd., for cable, and that of the British Thomson-Houston Co., Ltd., for switchgear.

**Belgium.**—The Belgian State Railway authorities in Brussels have just placed an order with the Ateliers de Construction et d'Estampage d'Awans, of Awans-Bierset, for a 25-ton electrically-operated travelling crane for the railway workshops at Malines.

**Cardiff.**—The E.L. and Tramways Committee met last week to receive some 50 tenders for plant, including a turbine alternator, a rotary converter and boiler-house accessories for the Roath power station. The Committee instructed Mr. Ellis (the manager) to tabulate them and report at a meeting called for to-day (Friday).

**Cape Town.**—The Council has placed an order with the British Westinghouse Co. for a 300-KW. rotary converter, with transformers and switch panel, for £1,033. The total cost of switchgear and delivery and erection of plant is estimated at £1,400.

**Epsom.**—The U.D.C. has accepted the tender of Messrs. Siemens Bros. & Co., Ltd., for 400 yards of cable, at £133, and for 1,400 yards, at £355.

**Faversham.**—The T.C. has accepted the tender of the Campbell Gas Engine Co., Ltd., for an exhausting scoop for the engine at the electricity works.

**Germany.**—Messrs. Windhoff & Co., of the Rheinen Maschinenfabrik, at Rheine, Westphalia, have submitted the lowest tender (£932) for the supply and erection of an electrically-operated locomotive turn-table, 65 ft. dia., for the Prussian State Railway authorities at Stettin.

**Glasgow.**—The T.C. Committee on Tramways Works and Stores has recommended acceptance of the following offers:—

Section pillar switches.—B.I. and Helsby Cables, Ltd.
Telephone switchboard for head office.—J. Macmillan & Co.
Westinghouse commutators.—P. R. Jackson & Co., Ltd.
Valves for Pinkston power station.—Dewrance & Co.; Hopkinson & Co.
Copper bonds.—R. R. Todd.
Lamps.—Lux Lamp Co., Ltd.

The Electricity Committee on Works has recommended that the following offers should be accepted:—

British Westinghouse Co., Ltd.—Two sets of 500-KW. size, at £2,573.
Siemens Bros. Dynamo Works, Ltd.—Two sets of 250-KW. size, at £1,787.

These offers were in each case the lowest.

**Government Contracts.**—The following tenders have been accepted during the past month by the Government Departments named:—

WAR OFFICE.

Electric cable.—Hooper's Telegraph and India-Rubber Works, Ltd.; Johnson & Phillips.

CROWN AGENTS FOR THE COLONIES.

Train lighting cells.—Chloride Electrical Storage Co., Ltd.
Spiral joints, &c.—Siemens Bros. & Co., Ltd.
Telegraph poles.—Bullers, Ltd.

INDIA OFFICE: STORE DEPARTMENT.

Accumulators.—Hart Accumulator Co.
Cells.—Siemens Bros. & Co.
Insulators.—Taylor, Tunnicliffe & Co.; Bullers, Ltd.
Lamps.—General Electric Co.
Projectors.—Siemens Bros. Dynamo Works Co.
Telegraph apparatus.—Elliott Bros.

POST OFFICE.

Telephonic apparatus.—Automatic Telephone Co., Ltd.; British L.M. Ericsson Manufacturing Co., Ltd.; London Electric Wire Co. and Smiths, Ltd.; Phœnix Telephone and Electric Works, Ltd.; Siemens Bros. & Co., Ltd.
Electric light cable.—Hooper's Telegraph and India-Rubber Works, Ltd.
Telephonic cable.—Callender's Cable and Construction Co., Ltd.; Connolly Bros., Ltd.; W. T. Henley's Telegraph Works Co., Ltd.; Siemens Bros. & Co., Ltd.; Western Electric Co., Ltd.
Stoneware ducts.—Albion Clay Co., Ltd.
Telegraphic ironwork.—Bullers, Ltd.
Cable distribution plugs.—Siemens Bros. & Co., Ltd.
Solder.—British Insulated and Helsby Cables, Ltd.
Rod zincs.—Eyre Smelting Co., Ltd.; Siemens Bros. & Co., Ltd.
Electric passenger lift, Dublin G.P.O.—A. & P. Steven.
Telephonic exchange equipment, Manchester City Exchange and Birmingham Victoria Exchange.—Western Electric Co., Ltd.; ditto, Smethwick P.O..—British L.M. Ericsson Manufacturing Co., Ltd.

**Keighley.**—The contract for the transformer, switchgear, three-phase motors, from ½ to 40 H.P., wiring, &c., in connection with the electrification of the Eastwood Bottoms Mill of Messrs. Ira Ickringill & Co., Ltd., has been placed with the "Schorch" Electrical Co.

**Long Eaton.**—The U.D.C. has accepted the tender of Messrs. Perks & Son, Ltd., at £3,003, for carrying out work at the electricity station.

**Luton.**—The tender of Messrs. S. H. Heywood & Co., Ltd., has been accepted by the T.C., at £725 10s., for the supply and erection of an electrically-driven 15-ton travelling crane.

**Newport (Mon.).**—The Tudor Accumulator Co. are to be asked to weld 300 tramway rail joints, at 27s. 6d. if carried out during the daytime, and at 35s. if done at night.

**Rochdale.**—Messrs. Turner Bros., Ltd., have placed an order with the "Schorch" Electrical Co., Ltd., for about 300 "Schorch" motors for their various departments, to replace mechanical shaft driving.

**London.**—HACKNEY.—The Electricity Committee has reported giving the following results of tenders received:—

HIGH-TENSION RING MAIN CONDUITS.

| | |
|---|---|
| **Foote & Milne, Ltd.** .. .. .. (recommended) | £16,019 |
| William Griffiths, Ltd. .. .. .. .. .. .. | 20,773 |
| Dick, Kerr & Co., Ltd. .. .. .. .. .. .. | 22,835 |

SUB-STATION PLANT.

| | |
|---|---|
| General Electric Co. (with Westinghouse transformers) .. .. | £6,991 |
| do. (with Brush transformers) .. .. .. | 6,691 |
| Brit. Westinghouse Electric and Manufacturing Co. .. .. | 7,006 |
| Siemens Bros. Dynamo Works, Ltd., (with Siemens transformers) | 7,051 |
| do. do. .. .. .. .. .. | 6,931 |
| British Thomson-Houston, Co. (with Brush transformers) .. | 7,159 |
| do. (with Westinghouse transformers) .. .. .. .. | 7,555 |
| do. (with Brit. Elec. Co.'s transformers) .. .. .. | 7,793 |
| do. (with Brush transformers and step starting) .. | 6,999 |
| do. (with Westinghouse transformers and step starting | 7,395 |
| do. (with Brit. Elec. Co.'s trans. and step starting .. | 7,658 |
| **Bruce Peebles, Ltd.** (with La Cour converters) (recommended) | 8,166 |
| Vickers, Ltd. (Brush transformers) .. .. .. .. .. | 8,189 |
| Electric Construction Co. (motor generators) .. .. .. .. | 8,496 |

The whole of the tenderers quote for rotary converters excepting Messrs. Bruce Peebles, Ltd., who quote for La Cour motor converter. In regard to these tenders the Committee says:—

The difficulty in adjudicating upon the tenders for this section is that of coming to a proper decision as to which class of machine is the most suitable for the purpose. The choice is a most controversial matter among engineers. Users of rotaries pin their faith to rotaries, and the same remark applies to users of the La Cour machine. The engineer has done all he can to obtain the experience of those who are running both types of machine, and we find that, at any rate in East London, opinion seems to favour the La Cour machine; but over the country generally there is no very definite bias in either direction—the one class of machine appears to be generally as satisfactory as the other. There is no doubt that the efficiency of the La Cour machine is slightly less than that of the rotary, which is a point in favour of the rotary, in addition to the advantage of lower first cost. These are undoubtedly two strong points in favour of the rotary, but there the advantages appear to end. In favour of the La Cour machines we have machines running at 500 R.P.M. instead of 750 R.P.M. which tends towards securing the quiet running we so much desire in our sub-stations, also less space is occupied, and possibly these machines are more stable during troublous times with the mains. In view of the fact that the La Cour machines are used at Poplar, Stepney and Stoke Newington and that there is a possibility in the not far distant future that East London Boroughs will be linked up, we think it desirable that our plant should as far as possible match that of our neighbours, and in all the circumstances, we feel that the Council will be better advised to adopt the La Cour type of machine. We therefore recommend that the tender of Messrs. Bruce Peebles, Ltd., amounting to £8,166, be accepted for the motor converters of the La Cour type.

SUB-STATION SWITCHGEAR AND CONNECTIONS.

| | |
|---|---|
| **Johnson & Phillips, Ltd.** .. .. (recommended) | £4,748 |
| General Electric Co., Ltd. .. .. .. .. .. | 5,187 |
| Electric Construction Co., Ltd. .. .. .. .. .. | 5,632 |
| A. Reyrolle & Co., Ltd. .. .. .. .. .. | 5,759 |
| Siemens Bros. Dynamo Works, Ltd. .. .. .. .. | 5,778 |
| British Thomson-Houston Co., Ltd. .. .. .. .. | 5,909 |
| Brit. Westinghouse Elec. and Manufacturing Co., Ltd. .. | 6,212 |
| Ferranti, Ltd. .. .. .. .. .. .. | 6,832 |
| Switchgear & Cowans, Ltd. .. .. .. .. .. | 5,985 |

After stating that these have been by far the most difficult tenders to come to a decision upon, the Committee gives reasons for the statement and recommends that the tender of Messrs. Johnson & Phillips, £4,748, with extras amounting to £942, making a total of £5,691, be accepted.

HAND-OPERATED TRAVELLING CRANES.

| | |
|---|---|
| **Herbert Morris, Ltd.** (standard design) (recommended) | £389 |
| do. (as specified) .. .. .. .. | 427 |
| Holt & Willets .. .. .. .. .. .. | 445 |
| Chatteris Engineering Works Co., Ltd. .. .. .. | 623 |
| John Smith (Keighley), Ltd. .. .. .. .. | 669 |

COMPARISON OF TENDERS WITH ESTIMATES.

| | | Tender. | Estimate. |
|---|---|---|---|
| Ring main conduits .. | Foote & Milne .. | £16,019 | £13,814 |
| Sub-station plant .. | Bruce Peebles, Ltd. .. | 8,166 | 9,450 |
| Switchgear .. .. | Johnson & Phillips .. | 5,691 | 5,985 |
| Travelling cranes .. | H. Morris & Co., Ltd. .. | 389 | 472 |
| | Totals .. .. .. | £30,265 | £29,721 |

HAMMERSMITH.—The B.C. Electricity Committee recommends the acceptance of the tender of Messrs. Langdon-Davies & Co., Ltd., at £63, for supply of one each 2, 3 and 9-H.P. motors which will be let out on hire to Messrs. W. A. S. Benson & Co. The other tenderers were:—Siemens, £84; Harding Churton, £86; British Westinghouse, £135.

**Southend-on-Sea.**—The T.C. has accepted the tender of Messrs. Crompton & Co., Ltd., for the electrical equipment of the sewerage works, at £498.

**Swindon.**—The following tenders have been accepted for the electricity works:—

Cooling tower.—Davenport Engineering Co., £685.
Water-softening plant.—Kennicott Water Softener Co., £558.
15-in. flanged cast-iron piping.—Sheepbridge Coal and Iron Co.

## FORTHCOMING EVENTS.

**Municipal Tramways Association.**—September 26th. At Sheffield. Annual Conference. Business meeting, and excursions.

**Salford Technical and Engineering Association.**—Saturday, October 4th. At the Royal Technical Institute. At 7 p.m. Lecture on "Automobile Construction," by J. A. Mackie, B. Eng.

**Institute of Marine Engineers.**—Monday, October 6th. At the Institute, Romford Road, E. At 8 p.m. Paper on "Fuel Gas Analysis and its Advantages," by A. E. Jones.

## NOTES.

**Institution and Lecture Notes.**—Junior Institution of Engineers.—The winter programme of the 33rd session of this Institution has been prepared.

The weekly informal discussion evenings will be recommenced on Friday, October 3rd, when Mr. W. A. Tookey, M.I.Mech.E. (Vice-Chairman), will lecture upon the subject of "Gas Engine Testing," at the offices of the Institution, 39, Victoria Street, Westminster, S.W.

A special popular lecture will be given by Mr. F. H. Taylor, A.M.I.E.E., A.M.Inst.M.E., on "Light—Ancient and Modern," at the Willesden Polytechnic on Wednesday, October 1st, at 8 p.m. Tickets may be had on application at the office of the Polytechnic, Priory Park Road, Kilburn, N.W.

**New Wireless Society.**—The inaugural meeting of the Wireless Society of London was held in the City of Westminster Schools, on Tuesday evening, the 23rd inst., the chair being taken by Mr. F. Hope-Jones, M.I.E.E., whose election was confirmed, together with the Committee, as follows:—H. F. Brand, M.A., B.Sc., Leslie McMichael, W. J. Shaw, V. W. Delves Broughton, W. J. Fry, E. W. Kitchen, A.M.Inst.C.E., Dr. F. C. Knight, L. F. Fogarty, and R. H. Klein (secretary). About 60 members were present. The objects of the Society were fully explained and its policy was discussed. The Committee was authorised to negotiate for the acquisition of club rooms in Hatton Garden and their equipment with a large aerial and suitable instruments. A letter from Sir A. F. King, K.C.B., on behalf of the Postmaster-General, was read at the meeting, welcoming the formation of such a Society, and indicating that certificates of its Advisory Committee would be accepted by him as qualifications for the granting of licences. Other letters were read from influential supporters, and it was announced that Dr. Silvanus P. Thompson, F.R.S., had consented to become one of the vice-presidents.

**Appointments Vacant.**—Educated men, with practical knowledge of cars and lorries, for Mechanical Transport Section of the Army Service Corps. See our advertisement pages this week.

**Educational.**—The Polytechnic, Regent Street. The new session opens on Monday, September 29th; courses are provided in electricity and magnetism, electrical engineering, telegraphy and telephony, under the direction of Mr. W. Hibbert.

**Visit to M.S. "Tynemount."**—An interesting visit was afforded on Saturday afternoon, the 13th inst., to about 30 members of the Newcastle Local Section, due to the kindness of Messrs. Swan, Hunter & Wigham Richardson, Ltd., who invited them to inspect the electrically-propelled vessel, the M.S. *Tynemount*. An opportunity was also given of inspecting the yard, and one of the new machine and erecting shops, which are fitted with the latest improvements in shop equipment.

The visitors were conducted round by Messrs. Thorne, Tweedy and Morgan, of the above firm's staff, and Mr. Taylor, the chief engineer of the boat. Tea was kindly provided by the firm later, terminating an instructive and enjoyable visit, which gave an insight into one of the latest applications of electrical engineering.

The following are a few particulars regarding this boat, which has been built to the order of the Montreal Transport Co. for service in the Canadian lakes and canals, where numerous locks have to be passed through, necessitating frequent and rapid starting and stopping and control; it is claimed that these qualities are obtained best by the electrical system adopted and fitted by Messrs. Mavor & Coulson, and described in a paper recently read before the Institution of Naval Architects.

*Particulars of Vessel.*—Length, 256 ft.; breadth, 42½ ft.; tonnage, 2,400; speed, 9 knots; single propeller, direct-coupled to three-phase squirrel-cage motor, speed 78 R.P.M., with two stator windings, connected to two generators, each of 235 K.V.A., 500 volts, driven by two Diesel engines, each of 300 H.P., four-cycle, six cylinders, 400 R.P.M.

One of the generators has eight poles, and is normally connected to one section of the motor-stator, wound for 40 poles. The other generator with six poles is normally connected to the other motor-stator section, wound for 30 poles. This condition gives a speed of 78 R.P.M. If the eight-pole generator is coupled to the 40-pole stator-winding a speed of about 58 R.P.M. is obtained, which will give full load to one coupled set. If either generator set is connected to its respective motor stator winding alone, about half-speed is obtained. The auxiliaries on the boat are steam-driven, steam being furnished by two donkey boilers fired with oil fuel.

Mr. Mavor dealt with the equipment of this boat first in his paper before the British Association at Portsmouth (Electrical Review, September 22nd, 1911), and again before the same body at Dundee, when he described the modified plans which were finally adopted (Electrical Review, September 20th, 1912). Drawings were reproduced in our pages showing the complete lay-out of the plant.

**Fire Brigade Tournament.**—The Osram Lamp Works Fire Brigade competed at the Annual Tournament of the London Private Fire Brigades' Association, winning the Second Prize for four men wet drill, and Third Prize for three men ditto. They also won the Geelong Challenge Shield. For the Championship of the Association they were placed third, their total time being 277⅗ seconds, against 270⅘ seconds by the winners. Twenty-three Brigades competed.

**Aisgill Disaster.**—On Friday last, at Kirkby Stephen, at the inquest on the victims of the Aisgill collision, the jury returned a verdict that the deaths were caused accidentally and by misadventure, with riders to the effect that great blame attached to the locomotive inspector at Carlisle for refusing to provide a pilot engine for the first train, and to the rear guard of that train for failing to protect it with detonators, while there were extenuating circumstances in the case of the driver and the fireman of the second train. A jury at Leeds, on a similar inquest, exonerated the railway officials concerned from criminal responsibility. On Tuesday, however, at the conclusion of an inquest at Carlisle in connection with the death, in hospital, of Sir A. P. Douglas, the jury returned a verdict of manslaughter against the driver of the second train, S. Caudell, who will, therefore, be tried at the next assizes. The driver admitted that the safety of the public ought to have been his first consideration, whereas he passed the signals without looking at them, because he was occupied with the boiler feed, the water being low. The Deputy-Coroner characterised this as an astounding admission, and we cannot understand how the other two juries arrived at their extraordinary verdicts in view of the facts before them.

**The Municipal Tramways Conference.** — On Wednesday morning the twelth annual Conference of the Municipal Tramways Association was opened at Sheffield, where in the Town Hall, the Lord Mayor, Alderman S. Osborn, cordially welcomed the members and delegates, at the same time paying a tribute to the services rendered to the city both by the present general manager, Mr. Fearnley, who is the president of the Conference, and by his predecessor, Mr. A. L. C. Fell. A vote of thanks to the Lord Mayor having been proposed by Alderman Miles, of Bolton, and seconded by Mr. Fell, Mr. Fearnley took charge of the proceedings.

Mr. Fearnley then read his Presidential Address, which constitutes a useful *résumé* of tramway progress during the past year, and naturally refers to the motor-'bus, in so far as it has to be considered in connection with future developments. Reading between the lines, we gather that the Sheffield Tramways Committee and its manager are rather favourably impressed with the work done by the ten Daimler 'buses which have been in use since last February. Some of these vehicles operate on very hilly roads, but the fares charged are in marked contrast to the cheap rides given on the tramways. Mr. Fearnley comes to the conclusion that the use of the 'bus now depends more on the road than on the vehicle, and suggests that in view of the permanent way which will shortly require renewing, there is an opportunity for some authority to convert a tramway route for 'bus working and compare results, the construction of a good road surface being one requirement.

Alderman Flint's paper on the "Advantages and Disadvantages of Platform Fare Collection," which followed, briefly describes with illustrations the ticket and fare system adopted on the Leicester Corporation Tramways. It might have been entitled "Punch, brothers, punch with care," but although the title scarcely indicates the contents of the paper, a lengthy discussion followed, mainly on the merits of the PAYE system.

While the Leicester and Aberdeen representatives, who were the only ones having actual experience of the system, were quite in favour of it, a good many other speakers were sceptical as to its supposed merits, especially under the conditions existing on British tramways. In this connection, Mr. McElroy pointed out that the PAYE system had been developed in America, where the universal fare facilitated its use; it had yet to be thoroughly tried in this country.

Councillor Fenton's paper on "The Maintenance of Paving on Tramway Track as affected by Sec. 28 of the Tramways Act, 1870" resulted in considerable discussion in the afternoon. Consideration of this subject generally results in some difficulty in discriminating, as regards proposed taxation, between the motor-'bus and other vehicles. Bailie Alston, Glasgow, ingeniously suggested that it was quite right to discriminate between a vehicle which earned its income on the streets (similarly to a tramway car) and one which merely transported goods over roads.

Generally the heavy repairs due to weighty motor vehicles using the tracks are compelling the Association to take the matter up in fairness to the tramway undertakings; in this action they are at one with the Tramways and Light Railways Association, who were represented by Mr. Harry England and Mr. H. M. Sayers.

Thursday's paper, by Mr. J. B. Hamilton, on "Urban Passenger Transport," aroused a great deal of interest. Although the author shows on paper that the motor-'bus cannot profitably compete with the electric tramway, presumably under provincial conditions, this is a maxim which all good tramway managers are supposed to subscribe to. The spectacle of Mr. Hamilton solemnly proving that 'bus costs cannot be under 10d. per mile, and will inevitably increase, when brother managers are experimenting right and left and buying still more 'buses, is rather humorous.

During the stay of the Association, the Corporation is providing with a liberal hand for the amusement of many of its visitors; as the electrical Press were not amongst the favoured ones, we are unable to refer at length to this feature of the Conference.

**Accident.**—Peebles.—At an inquiry regarding the death of an engineman in the employment of the Peebles Hotel Hydropathic Co., Ltd., who was caught by a belt while starting the gas engine which drives the dynamo, a witness stated that he understood it was the intention of the company to put in new plant altogether outside the building, as the noise of the engine annoyed the people in the hydro.

**Railway Signals and Mercury Vapour Lamps.**—In view of the very wide publicity that has been given to the fact that engine drivers on the Great Northern Railway became perplexed at night by the appearance of a green light over the distant signals on approaching Peterborough, which was afterwards discovered to be due to a mercury vapour lamp used for advertising purposes on the Peterborough Kinema, the Westinghouse Cooper Hewitt Co., Ltd., point out that confusion of this kind can be very readily overcome by using a special globe or special reflectors that have been devised and largely adopted with these lamps for railway work. With this globe the appearance of the lamp from a distance is altered, although the characteristic quality of the mercury vapour light as light "to see by" is maintained.

**Electric Garage.**—A feature of the electrical vehicle section of the Electrical Exhibition, which is to be held in New York, from October 15th to 25th next, will be a motor garage, fitted out with all the apparatus and equipment requisite for the care and charging of electric vehicles.

**Fatality.**—It is reported that on Wednesday an electrical engineer named Carpenter was killed by electric shock at the Sittingbourne paper mills.

## OUR PERSONAL COLUMN.

*The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the* ELECTRICAL REVIEW *posted as to their movements.*

**Central Station Officials.**— At the T.C. meeting at Whitehaven, on 10th inst., the Mayor and others made complimentary remarks with respect to the qualifications and abilities exhibited by MR. SANKEY during his holding the position of electrical engineer.

Mr. E. W. L. NICOL, assistant station superintendent under Mr. Herbert A. Fleet to the Yorkshire Electric Power Co., has been appointed fuel expert to an important London organisation, at a commencing salary of £300.

At East Grinstead (Sussex), on Monday, the marriage took place of MR. EDWIN DADSWELL, of the Keighley (Yorks.) Corporation electricity staff, and Miss Doris Foster, fourth daughter of the late Mr. Foster, Hazelden, East Grinstead.

On the occasion of his marriage to Miss Nancy Adams, daughter of Mr. S. H. Adams, of Fulford (Yorks.), MR. H. D. LEATHER has been presented with a silver dish by the management and staff of the Minehead Electric Supply Co., Ltd.

MR. W. H. JOHNS, of Saltley, Birmingham, has been appointed gas and electrical engineer to the Malvern U.D.C.

MR. T. W. DAVIES, for 4½ years station superintendent at the Corporation electricity works at Wrexham, who has resigned, has been presented by the staff and employés with a clock and silver-mounted walking stick, with a silver-mounted umbrella for his wife.

MR. JOHN R. DAVISON, of the staff of the Poplar electricity works, and formerly of H.M. Dockyard, Devonport, has been appointed shift engineer at the Stuart Street generating station, Manchester.

The Rhondda U.D.C. has appointed MR. JAMES BOWMAN as engineering clerk-of-works to supervise the erection of its refuse destructor and electric generating works.

MR. R. W. WILLIS has resigned his appointment as assistant electrical and mechanical engineer at the Swindon Council's electricity works. The vacancy is not to be filled for the present owing to an amendment having been passed in the Council, on the motion of a gentleman who said that personally he did not consider that a small concern like the electricity department ought to carry two engineers. At present each Committee had its own officials—there was no organisation and no cohesion. "What they required was an engineer able to guide and supervise the different departments. There were too many assistant engineers." The passing of the amendment by 17 votes to 14 was followed by expressions of regret. One speaker said that the amendment had not been understood, and another that it was equivalent to charging the Electricity Committee with spending money unnecessarily.

MR. F. V. BROWNE, of the Rochdale Corporation electrical staff, and late of Norwich, has secured an appointment under the Great Central Railway as substation attendant at Immingham Docks.

**Tramway Officials.**—The Tramways Committee of West Ham Town Council proposes to grant MR. F. EGGINGTON, principal assistant in charge of the tramways department, a gratuity of £20 for extra services rendered since the resignation of the tramways manager (Mr. H. E. Blain), whose duties he had taken up until the new manager took over the position on August 18th last.

The staff and employés of the Bradford City tramways have presented an oak bureau and bookcase to MR. T. B. MOSELEY, on his marriage. Mr. Moseley also received a barometer from the Bradford City Tramways Military Band.

The Brighton T.C. has increased the salary of MR. W. N. BROOKS, tramway traffic superintendent, from £3 to £3 5s. per week.

**General.**—On the occasion of his marriage, MR. J. P. STRANGE has been presented with a chiming clock by the staff of the Electric Installation Co., of Tunbridge Wells.

The West Ham Testing Laboratory has acquired the business of fuel analysts hitherto conducted by Messrs. Greenwood & Wells, 16, York Place, Baker Street, W.

MR. E. H. LAMB, demonstrator and scientific adviser to Messrs. W. H. Allen, Son & Co., Ltd., electrical and general engineers, of the Queen's Engineering Works, Bedford, who is leaving after 10 years with the firm, has been presented by the directors with a library of 28 volumes of engineering and other works, and by the staff, pupils and apprentices with a barometer, cigarette case and silver rose bowl.

We are informed that, by arrangement with the directors of Messrs. Siemens Bros. Dynamo Works, Ltd., MR. E. P. BARFIELD will sever his connection with the Dalston Lamp Works at the end of the present month. He will, therefore, take up his new appointment as general commercial manager with the Edison & Swan United Electric Light Co., Ltd., early next month.

**Obituary.**—SIGNOR CALISSANO, Italian Minister of Posts and Telegraphs, died suddenly on Sunday afternoon.

**Will.**—MR. J. S. JEANS, whose death was announced some weeks ago, left £42,218 net personalty.

## CITY NOTES.

### Crompton & Co., Ltd.

THE statutory meeting of the shareholders of this company was held on Monday, at Salisbury House, London Wall, E.C., Mr. C. F. Tufnell presiding.

The CHAIRMAN said that the meeting was called in order to comply with the requirements of the Companies' Act. Although no formal business had to be transacted, they would doubtless like to hear something from him as to the present position of the company. It would be observed from the report that the whole of the preference shares offered had been allotted, and he was particularly pleased to state that the reconstruction of the company —although involving a considerable amount of work—had been carried through without any interruption whatever of the company's business. At the last meeting of the old company, in June, he was able to inform the shareholders that the new company — which was to take over the business as from April 1st — would start at that date with a considerable increase of orders in hand, as compared with the value of work in hand on the same date in the previous year. He was glad to be able to state that the orders received since that date showed a satisfactory increase on the orders for the corresponding periods of the previous three years. They had made some changes in the staff at the headquarters and at the works. Mr. Edwin Reeves—for many years secretary of the old company, and who acted also as joint manager during the last 18 months of the old company's existence —had been appointed managing director and secretary, and all of them who knew Mr. Reeves and his loyal work in the past would, he felt sure, allow that no better appointment could have been made. The directors had also appointed Mr. Thos. Britten—a gentleman with the highest credentials, and in whom they had every confidence—as works manager at Chelmsford. The reconstruction offered them an opportunity, of which they were taking advantage, to introduce certain changes into the business, which they were confident would have a marked effect on the earning power of the company. It was, perhaps, not advisable for him to go into details, but the shareholders could rest assured that whatever they did they would bear in mind that they had inherited from the old company a reputation which attached to the name of Crompton for good work and straightforward dealing, and they were determined to uphold that good name. As the company had really only been in existence three months, it was too early to talk about the profits they were making, but he trusted the shareholders would be satisfied when they saw the balance-sheet of the first year's working, which they hoped to present when they next met them. As most of them were shareholders in the old company, they might like to hear something about the last year's working of that company. At the meeting of the old shareholders on June 19th he stated that they hoped the results of the year's working, to March 31st (the accounts for which were not then completed), would show a profit sufficient to pay debenture interest. As a matter of fact, the results were better than this. After paying depreciation on the usual scale, debenture interest, interest on bank loans, and other charges against revenue account, there was a balance in hand of some £800. He did not know whether the shareholders were altogether aware of the scope of the company's business. In the first place, at their works at Chelmsford, they turned out dynamos, alternators, motors of various sizes for direct and alternating current, arc lamps of many descriptions, projectors or searchlights for naval, military and other purposes, and he might say that the British Admiralty was one of their biggest customers for this class of work, and their field service projectors gave a good account of themselves at Adrianople during the late war. They also did a large business in ceiling fans, particularly for the East. Their electrical measuring instruments were well known, and the output was steadily going up. They had a high reputation for the finish of their switchboards and switchgear. They also took on contracts to manufacture, supply and erect electric cranes, capstans, winches and various work of this description. They also did a big business

in the electrical equipment of factories and the supply and erection of electrical plant for collieries and mines, at home and abroad. They carried out the complete equipment of lighting stations, including the laying of mains, at home and abroad, and, at the present moment, they were busy on various town lighting jobs of this description. His object in giving this information to the shareholders was that he wanted them to help the company by trying to influence business in their direction. They were a new company, and they "meant business," as the expression went. Their determination was to earn dividends at the earliest possible moment, and they wished to look upon the shareholders as their best friends and customers.

Replying to questions, the CHAIRMAN said it was the intention of the board to apply for a Stock Exchange quotation for the new ordinary and preference shares at the earliest possible moment. The £20,985 representing the reserve fund of the old company had gone into the assets of the new company which at present had no reserve fund.

MR. GIBSON said that as an old shareholder of Crompton's he would like to express his great satisfaction at the way in which the reconstruction had been carried through. They were particularly indebted to Mr. Reeves, who, he was glad to see, had been appointed managing director and secretary. The board had had a very anxious time, and he was sure it was the wish of the shareholders to thank them for their work.

The vote was carried with acclamation, and the CHAIRMAN, in acknowledging the same, said he fully endorsed all that Mr. Gibson had said with regard to the great services which Mr. Reeves had rendered in carrying through the reconstruction.

## United Electric Car Co., Ltd.

MR. R. B. BARNINGHAM presided at the annual general meeting at Preston, on the 17th inst., and said that the past year's working was not so satisfactory as that of the previous year. The net profit on that occasion was the best since 1907, viz., £15,267. The past year had certainly not been a boom year in the demand for tramcars, and, in the circumstances, the directors considered the net profits of £10,809 satisfactory. Such had been their anxiety to obtain orders that they had often to take work at prices which, although showing a small margin of profit did not really cover the extra prices of materials. The keen competition had mainly affected them for foreign work, and had come chiefly from American and Continental firms. The order books and prospects were slightly better than 12 months ago. They should take the earliest opportunity to build up their general reserve to provide for the loss in the realisation of the Hadley and Trafford Park works. The report was adopted, and it was decided to pay a dividend of 5 per cent. on the ordinary shares and to carry forward £1,558. Messrs. R. H. Prestwich (Manchester) and J. Kerr were re-elected directors.

**Official Announcements re Companies.**—Unless cause is shown to the contrary, the following companies will be struck off the register within three months :—

Anglo-French Turbines, Ltd.
British Electro-Metallurgical Products Co., Ltd.
British Rubber Regenerating Co., Ltd.
Engineering Digest Publishing Syndicate, Ltd.
Heat, Light and Power Syndicate, Ltd.

**Stock Exchange Notice.**—Application has been made to the Committee to allow the following to be quoted in the Official List :—

Minaes Geraes Electric Light and Tramways Co. (Companhia de Electricidade e Viacao Urbana de Minas Geraes).—£120,000 5 per cent. first mortgage bonds, Nos. A1 to 1,000 of £20 and B1 to 1,000 of £100 each.

**International Light and Power Co.**—A dividend of 1½ per cent. (being at the rate of 6 per cent. per annum), less income-tax, upon the preference shares, is announced for the quarter ending September 30th.

**South America.**—The directors of the Compania de Tramways Electricos del Sud, in their report for the year ended June 30th, state that net profits, including $28,864 brought forward from the preceding year, amounted to $231,843, which was distributed as follows :— Reserve funds, $14,208 ; directors, $18,268 ; 6 per cent. dividend, $179,910 ; forward, $19,457. Reserve and renewal funds amount to $337,292. Gross receipts for the year were $1,127,603, an increase of $52,411 ; expenditure was $834,681, an increase of $50,330. The number of passengers carried was 8,040,835, as compared with 7,507,976. There was a decrease of 292,063 in the kilometres run, though the cost of electrical energy showed an increase of $27,756. During the year $1,000,000 in new shares were issued, which were taken up by French capitalists at par.—*Review of the River Plate.*

**Marconi's Wireless Telegraph Co., Ltd.**—The following dividends will be payable on and after October 1st, 1913 :— On the 7 per cent. cumulative participating preference shares, a final dividend for the year 1912 of 10 per cent. ; an interim dividend for the year 1913 of 7 per cent. On the ordinary shares a final dividend for the year 1912 of 10 per cent.

**Kalgoorlie Electric Power and Lighting Co.**—A dividend at the rate of 6 per cent. per annum on the preference shares for the half-year ending September 30th is announced.

## British Westinghouse Electric and Manufacturing Co., Ltd.

AT an extraordinary general meeting, which will be held at Hamilton House, Victoria Embankment, London, E.C., to-day (Friday), the following and a number of incidental resolutions will be considered :—

"That the capital of the company be reduced from £1,875,000 (divided into 500,000 preference shares of £3 each and 75,000 ordinary shares of £5 each, all fully paid) to £1,150,000 (divided into 500,000 preference shares of £2 each and 75,000 ordinary shares of £2 each), and that such reduction be effected by cancelling paid-up capital which has been lost or is unrepresented by available assets, to the extent of £1 per share on each of the preference shares and to the extent of £3 per share on each of the ordinary shares, and by reducing each preference share to a share of £2 and each ordinary share to a share of £2."

In their circular calling the meeting, the directors say :—"The shareholders are aware from the remarks of the chairman at recent meetings that it has been in contemplation for some time past to make a further reduction in the capital of the company. Proposals would have been placed before the shareholders before this but for the fact that the questions between the company and the Underground Electric Railways Co., of London, were still unsettled, and your directors were desirous of knowing exactly what the outcome of the proceedings would be before formulating the necessary plan. Those proceedings having now reached a final solution, your directors are of opinion that in the interests of the company it is not desirable to delay the matter any longer. The directors recommend that a reduction in the capital of the company to the extent of £725,000 be made. Of this amount £225,000 would be devoted to writing down patents and goodwill to £150,000. The balance of £500,000, together with the balance at the credit of profit and loss account on December 31st, 1912, on the accounts of which year the reduction of capital will be based, would be devoted to the depreciation of buildings, plant, machinery and investments, the writing off of the expenses of the issue of the prior lien debentures, and the loss sustained in connection with the Underground Electric Railways Co. of London, which has been £52,050. To meet this reduction in the capital assets of the company they recommend that the share capital be reduced by writing off £1 per share from the 500,000 preference shares and £3 per share from the 75,000 ordinary shares. In order to maintain the same relative position of the two classes of shares as it stood at the incorporation of the company, it is proposed that the rate of dividend be increased as follows :—

"On the preference shares from 10 per cent. to 15 per cent., and on the ordinary shares from 12 per cent. to 30 per cent. ; the division of any surplus profit between the two classes of shareholders remaining as at present—viz., one-fourth thereof among the preference and three-fourths among the ordinary shares.

"The result would be that before division of surplus profits, the preference shares would be entitled to the same amount of preferential dividend—viz., 6s. per share, and the ordinary shares to the same amount of dividend—viz., 12s. per share, as they were respectively entitled to at the date of the incorporation of the company. In other words, the 500,000 preference shares will be entitled to participate in each year in the profits up to £150,000 before any distribution is made among the ordinary shareholders. In the event of liquidation the rights of the two classes of shares remain as at present, so that the preference shares shall first receive £5 per share before any distribution is made to the ordinary shares. The voting power now enjoyed by the respective classes will not be affected. The board strongly recommends the adoption of these proposals in the interests of shareholders themselves. If the reduction is approved, the resumption and maintenance of the payment of dividends will be much facilitated."

## Callender's Share and Investment Trust, Ltd.

MR. T. O. CALLENDER (chairman) presided, on September 18th, at the first annual meeting of the above company. The proceedings were purely formal, and the following report (to which brief reference was made last week) was adopted on the motion of the chairman. The earnings in respect of interest and dividends on investments from May 10th, 1912, the date on which the company commenced business, to August 31st, 1913, amounted to £14,720. A further amount of about £1,400 will become due in respect of dividends on ordinary shares, which there is every reason to believe will be punctually paid, but as these dividends have not yet been declared, no credit has been taken for this sum in the accounts now submitted. After paying all working expenses and writing off £1,007 in respect of preliminary expenses and cost of issue of debenture stock, the gross profit amounted to £19,227. From this has to be deducted interest on debenture stock and calls paid in advance, £7,022, leaving an available balance of £12,205. It is proposed to pay a dividend at the rate of 5 per cent., less income-tax, whereof an interim dividend of 2½ per cent., less income-tax, was paid on May 8th, 1913. This will absorb £8,270 ; redemption fund, amount deposited with debenture stock trustees, being first annual payment, £1,800, leaving to be carried forward £2,135. During the year advances have been made to Callender's Cable and Construction Co., Ltd., and the balance now due in respect thereof is £102,000. The interest on these advances has been paid up to date. The total cost of the formation of the company and the issue of the debenture stock was £7,673. Of this £1,007 has been written off as above, and it is proposed to write off the remainder, £6,666, by nine annual instalments of £741.

## STOCKS AND SHARES.

Tuesday Evening.

The principal feature in the Stock Exchange markets since our last notes appeared has been the dropping, and the raising of the fear that there might be a general strike on all the railways. Although the markets professed that they did not expect the threat would materialise, precautionary measures were taken against the possibility of such a thing; and as soon as the pressure was withdrawn, prices bounded up sharply. This, of course, was particularly the case in the Home Railway list, but Traction shares of most kinds were affected, and our catalogues show a fair number of improvements on the week, these improvements in some cases simply replacing the losses sustained just previously.

The demand for Electric Lighting shares has come to something of a halt. Speculation, what little there is of it in so sober-minded a market, looks to the price of City of London shares for its inspiration. If City "Lights" are quiet, it may be taken for granted that there will be nothing interesting amongst the rest; the Cities for the past few days have been sticking round about 17. Reference was made last week to the strength of County Ordinary; the price gained 25s., and at one time buyers came along at 12½. They were supplied without a great deal of difficulty, however, and the price thereupon fell back to 11⅞, thus showing a fall of 12s. 6d. on the week. The Preference lost their previous 5s. gain. Amongst the others, Kensington and Knightsbridge Ordinary hardened to 7¾, at which price the yield is exactly 5 per cent. on the money, taking the last dividends as the basis. Westminsters are better at 9¼. There is a quiet demand for Metropolitans, but the only change in the company's stocks is a rise of a point in the Second Debenture. Other shares are steady, without quotable alterations.

Amongst Home Railways, Metropolitans have recovered their previous fall of 1¼, and Districts at 34½ are ¼ higher. The principal activity in this group has occurred in the Underground Electric issues. The £10 shares fell to 3⅝, rallying on Tuesday to 4, and so showing a 5s. rise on the week. The 1s. shares remained about half-a-sovereign, varying between 9s. 9d. and 10s. 9d. as the outside prices. Buyers came in for the Income bonds at 90, and as soon as the sentiment changed, the price promptly hardened to 91½. British Electric Tractions are better. Central London Guaranteed Assented Ordinary stock eased off to 80. Metropolitan Electric Trams 4½ per cent. Debenture fell 2 to 84, while the pre-ordinary list tends to droop a little here and there.

The reconstruction proposals put forward by the British Westinghouse Company resulted in a rise of 1/16 in the Company's Preference shares. The scheme is regarded favourably on the whole by the market; and though it is open to criticism in certain directions, it is considered to be a fair attempt to deal with the difficult situation that has arisen by reason of the past misfortunes of the concern. Modifications may be suggested at the meeting, which is to be held on the Friday in this week. British Aluminium Ordinary are also harder; and of the Cable shares, Callenders rose ¼ to 11¾. The Willans & Robinson's shares have been removed from the lists for the time being, and the price of the 4 per cent. Debenture stock at 57½ shows a nominal rise of 1. Electric Construction Preference shares are better. Aron Preference have fallen back.

The Telegraph group is very steady. It is difficult to account for the continued dulness of Anglo-American Telegraph stocks, and the market explanation—namely, that there has been some pressure to sell on behalf of deceased estates—is not an entirely satisfying one to those who have watched the decline that has been going on so steadily for the past few weeks. The Preferred has now got back to 106. Probably the real reason for the depression is the vague fear that if the United States Government takes active steps against the trusts in that country, the merger which took over the Anglo-American Co. may have to be dissolved. The Deferred stock remains at 23¼.

Of the Eastern securities, Eastern Ordinary is ¼ up at 129. Eastern Extension Debenture is a similar amount to the good at 93½, and Globe Preference rose ⅛ to 12⅜. The Company has declared its usual quarterly dividend. Indo-Europeans continue to advance, and West India and Panama shares are steady. Mackay Common fell 3 points, although the Preference at 69½ is 1½ better. Chile Telephone shares are a little lower. National Telephone Deferred holds its advance at 7⅜. The rise in Marconis was checked by profit-taking sales as the end of the account approached. After touching 4¼, the price of the parent shares receded to 3⅞, this having its natural effect upon the Preference shares and upon the issues of the subsidiaries.

The Latin-Canadian group presents a few points of special interest, but the market for the various companies' bonds is becoming restricted in its supply of stock, and prices are therefore hardening. Mexico Tramways First Bonds, Rio Bonds of both kinds, and Sao Paulo Tramway Debentures are better to the extent of ¼ to a point. Mexico Tramways shares eased off to 98½ in sympathy with a drop in Brazilian Tractions. The latter had been run up to 99, and the Preferred to 101½, but from these prices there were slight reactions that took the quotations back to 98 and 100 respectively, the Common showing ½ rise on the week. There is quiet buying going on of various foreign tramway shares, Singapores, for instance, being in demand this week at 5s. Lisbon Electrics are flat, both Ordinary and Preference falling. Electrical Development of Ontario bonds put on 1½ to 93. Monterey bonds at 74 are 1½ lower. The British Columbia issues show small rises.

Keen interest follows the course of raw rubber, and of the market in the shares. Both had a relapse after hardening up a little, the improvement being brought about by a proposal to establish a central selling agency which might be able to regulate the price of the raw material. To this suggestion a good deal of support has been promised; but not all the people most interested see eye to eye over the matter, and unless there is practical unanimity, it is difficult to understand how the market can derive much benefit from this protective influence. At Manaos, one of the ports from which Brazil rubber is exported, trade is reported to have come practically to a standstill in consequence of the crisis in the rubber trade.

## MARKET QUOTATIONS.

It should be remembered, in making use of the figures appearing in the following list, that in some cases the prices are only general, and may vary according to quantities and other circumstances.

### Wednesday, September 24th.

| CHEMICALS, &c. | Latest Price. | Fortnight's Inc. or Dec. |
|---|---|---|
| *a* Acid, Hydrochloric .. .. per cwt. | 5/- | .. |
| *a* „ Nitric .. .. .. „ | 22/- | .. |
| *a* „ Oxalic .. .. .. per lb. | 3d. | .. |
| *a* „ Sulphuric .. .. .. per cwt. | 5/6 | .. |
| *a* Ammoniac Sal .. .. .. „ | 42/- | .. |
| *a* Ammonia, Muriate (large crystal) per ton | £30 10 | .. |
| *a* Bleaching powder .. .. .. „ | £6 5 | .. |
| *a* Bisulphide of Carbon .. .. „ | £18 | .. |
| *a* Borax .. .. .. .. .. „ | £17 10 | .. |
| *a* Copper Sulphate .. .. .. „ | £24 | 5s. inc. |
| *a* Lead, Nitrate .. .. .. „ | £30 | .. |
| *a* „ White Sugar .. .. .. „ | £27 10 | £1 10s. inc. |
| *a* „ Peroxide .. .. .. „ | £32 | .. |
| *c* Methylated Spirit .. .. .. per gal. | 2/6 | .. |
| *a* Potassium, Bichromate, in casks per lb. | 3½d. | .. |
| *a* Potash, Caustic (88/90 %) .. per ton | £22 10 | .. |
| *a* „ Chlorate .. .. .. per lb. | 3½d. | .. |
| *a* „ Perchlorate .. .. .. „ | 4½d. | .. |
| *a* Potassium, Cyanide (98/100 %) .. „ (for mining purposes only) | 7½d. | .. |
| *a* Shellac .. .. .. .. per cwt. | 100/- | 5/- dec. |
| *a* Sulphate of Magnesia .. .. per ton | £4 10 | .. |
| *a* Sulphur, Sublimed Flowers .. „ | £8 10 | .. |
| *a* „ Recovered .. .. „ | £5 10 | .. |
| *a* „ Lump .. .. .. „ | £5 | .. |
| *a* Soda, Caustic (white 70/72 %) .. „ | £10 5 | .. |
| *a* „ Chlorate .. .. .. per lb. | 8½d. | .. |
| *a* „ Crystals .. .. .. per ton | £8 5 | .. |
| *a* Sodium Bichromate, casks .. per lb. | 3d. | .. |
| **METALS, &c.** | | |
| *b* Aluminium Ingots, in ton lots .. per ton | £96 | .. |
| *b* „ Wire, in ton lots (1 to 14 S.W.G.) „ | £121 6 8 | .. |
| *b* „ Sheet, in ton lots .. „ | £126 | .. |
| *p* Babbitt's metal ingots .. .. „ | £50 to £221 | .. |
| *c* Brass (rolled metal 2" to 12" basis) per lb. | 8¼d. | .. |
| *c* „ Tube (brazed) .. .. „ | 10¼d. | ⅛d. dec. |
| *c* „ „ (solid drawn) .. „ | 9¼d. | .. |
| *c* „ Wire, basis .. .. .. „ | 8¼d. | .. |
| *c* Copper Tubes (brazed) .. .. „ | 1/- | .. |
| *c* „ „ (solid drawn) .. „ | 11⅛d. | .. |
| *g* „ Bars (best selected) .. per ton | £91 | £5 inc. |
| *g* „ Sheet .. .. .. „ | £91 | £5 inc. |
| *g* „ Rod .. .. .. .. „ | £91 | £5 inc. |
| *d* „ (Electrolytic) Bars .. „ | £78 10 | £1 15s. inc. |
| *d* „ „ Sheets .. „ | £96 10 | £1 15s. inc. |
| *d* „ „ Rods .. „ | £84 | £1 15s. inc. |
| *d* „ „ H.C. Wire per lb. | 10¼d. | ⅛d. inc. |
| *f* Ebonite Rod .. .. .. „ | 4/6 | .. |
| *f* „ Sheet .. .. .. „ | 4/- | .. |
| *n* German Silver Wire .. .. „ | 1/10 | .. |
| *h* Gutta-percha, fine .. .. .. „ | 6/6 to 7/6 | .. |
| *h* India-rubber, Para fine .. .. „ | 3/8 | .. |
| *l* Iron Pig (Cleveland warrants) .. per ton | 54/9 | .. |
| *l* „ Wire, galv. No. 8, P.O. qual. „ | £14 | .. |
| *g* Lead, English Pig .. .. .. „ | £21 | 2/6 inc. |
| *m* Manganin Wire No. 28 .. .. per lb. | 6/6 | .. |
| *g* Mercury .. .. .. .. per bot. | £7 5 | .. |
| *e* Mica (in original cases) small .. per lb. | 6d. to 8s. | .. |
| *e* „ „ „ medium „ | 8/6 to 6/- | .. |
| *e* „ „ „ large .. „ | 7/6 to 11/- | .. |
| *o* Nickel, sheet, wire, &c. .. .. „ | 3/6 to 4/6 nom | .. |
| *p* Phosphor Bronze, plain castings „ | 1/1 to 1/3½ | .. |
| *p* „ „ rolled bars & rods „ | 1/0½ to 1/2 | .. |
| *p* „ „ rolled strip & sheet „ | 1/2½ to 1/5½ | .. |
| *o* Platinum .. .. .. .. per oz. | 185/- | .. |
| *d* Silicium Bronze Wire .. .. per lb. | 11d. | .. |
| *r* Steel, Magnet, in bars .. .. per ton | £55 | .. |
| *g* Tin, Block (English) .. .. „ | £194 to £195 | £2 dec. |
| *n* „ Wire, Nos. 1 to 16 .. .. per lb. | 2/7 | .. |
| *p* White Anti-friction Metals .. per ton | £50 to £228 | .. |
| *k* Zinc, Sh's (Vieille Montagne bnd.) „ | £26 10 | .. |

Quotations supplied by—

*a* G. Boor & Co.
*b* The British Aluminium Co., Ltd.
*c* Thos. Bolton & Sons, Ltd.
*d* Frederick Smith & Co.
*e* F. Wiggins & Sons.
*f* India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.
*g* James & Shakspeare.
*h* Edward Till & Co.
Bolling & Lowe.
*k* Morris Ashby, Ltd.
*l* Richard Johnson & Nephew, Ltd.
*m* W. T. Glover & Co., Ltd.
*n* P. Ormiston & Sons
*o* Johnson, Matthey & Co., Ltd.
*p*
*r* W. F. Dennis & Co.

**Globe Telegraph and Trust, Co.**—The directors have declared an interim dividend of 2s. per share on the ordinary shares for the past quarter.

**Stothert & Pitt, Ltd.**—A financial daily states that a dividend of 10 per cent., free of income-tax, on the ordinary shares for the year is announced, £2,000 is placed to reserve, and £2,100 carried forward.

# SHARE LIST OF ELECTRICAL COMPANIES.

## ENGLISH ELECTRICITY SUPPLY AND POWER COMPANIES.

| NAME. | Stock or Share. | Dividends for 1912. | Dividends for 1913. | Closing Quotations Sept. 23rd. | Rise + or Fall — | Present Yield p.c. £ s. d. |
|---|---|---|---|---|---|---|
| Bournemouth & Poole, Ord. .. | * | | | | | |
| Do. 4½ % Pref. .. .. .. | 10 | 6 | 5† | 9½ — 10⅞ | .. | 5 17 1 |
| Do. Second 6 % Pref. .. | 10 | 4½ | 4½ | 8¾ — 9⅜ | .. | 4 14 9 |
| Do. 4½ % Deb. Stock .. .. | 10 | 6 | 6 | 9⅞ — 10⅜ | .. | 5 15 8 |
| Brompton & Kensington, Ord... | Stock | 4½ | 4½ | 95 — 98 | .. | 4 11 10 |
| Do. 7 % Cum. Pref. .. .. | 5 | 10 | 9† | 8½ — 9 | .. | 5 11 1 |
| Central Electric Supply, 4 % Guar. Deb. | 5 | 7 | 7 | 8½ — 8⅝ | .. | 4 1 2 |
| Charing Cross, West End & City Do. 4½ % Cum. Pref. .. .. | 100 | 4 | 4 | 94 — 97 | .. | 4 2 6 |
| Do. "City Undertaking" 4½ % Cum. Pref. | 5 | 5 | 5† | 4⅜ — 4⅞ | .. | 5 2 7 |
| Do. Do. 4 % Deb... .. | 5 | 4½ | 4½ | 4⅛ — 4⅜ | .. | 4 17 3 |
| Chelsea, Ord. .. .. .. .. | 5 | 4½ | 4½ | 8½ — 4 | .. | 5 12 6 |
| Do. 4½ % Deb. .. .. .. | 100 | 4 | 4 | 90 — 92 | .. | 4 7 0 |
| City of London, Ord. .. .. | Stock | 4 | 4 | 90 — 92 | .. | 4 7 0 |
| Do. 6 % Cum. Pref. .. .. | Stock | 4½ | 4½ | 94 — 97 | .. | 4 12 9 |
| Do. 6 % Deb. .. .. .. | 10 | 9 | 6† | 16½ — 17½ | .. | 5 2 10 |
| Do. 4½ % Second Deb. .. | 10 | 6 | 6 | 12⅜ — 13½ | — ⅛ | 4 9 0 |
| County of London, Ord... | Stock | 5 | 5 | 114 —118 | .. | 4 4 9 |
| Do. 6 % Pref. .. .. .. | 100 | 4½ | 4½ | 99 —101 | .. | 4 9 1 |
| Do. 4½ % Deb. .. .. .. | 10 | 6 | 5† | 11⅝ — 12½ | — ⅛ | 4 19 0 |
| Do. 4½ % Second Deb. .. | 10 | 6 | 6 | 11⅝ — 12⅜ | — ⅛ | 4 19 0 |
| Croydon, Ord. .. .. .. .. | Stock | 4½ | 4½ | 102½ —104½ | .. | 4 6 2 |
| Do. 4½ % Deb. .. .. .. | Stock | 4½ | 4½ | 98 —101 | .. | 4 9 1 |
| Edmundson's, Ord. .. .. | £3 | .. | .. | ⅜ — ⅝ | .. | Nil |
| Do. 6 % Cum. Pref. .. .. | 5 | 6 | 6 | 4 — 4⅜ | .. | 3 8 7 |
| Do. 6% Non-Cum. Pref. .. | 5 | .. | .. | 1⅝ — 2 | .. | .. |
| Do. 4½ % First Mort. Deb. .. | 100 | 4½ | 4½ | 80 — 83 | .. | 5 8 5 |
| Folkestone .. .. .. .. | 5 | 6 | 6 | 4½ — 5 | .. | 6 0 0 |
| Do. 5 % Cum. Pref. .. .. | 5 | 5 | 5 | 4½ — 5 | .. | 5 0 0 |
| Do. 4½ % First Deb. .. .. | 100 | 4½ | 4½ | 89 — 91 | +1 | 4 19 0 |
| Hove .. .. .. .. .. | 5 | 9 | .. | 7⅞ — 8½ | .. | 5 9 1 |
| Kensington & Knightsbridge, Ord | 5 | 8 | 8† | 7⅛ — 8 | + ¼ | 5 0 0 |
| Do. 4 % Deb. .. .. .. | Stock | 4 | 4 | 88 — 91 | .. | 4 7 11 |
| Kent Elec. Power, 4½ % Deb. .. | Stock | 4½ | 4½ | 74 — 78 | .. | 5 15 5 |
| London Electric, Ord. .. .. | 8 | 2½ | .. | 1¼ — 1⅜ | .. | 4 7 9 |
| Do. 6 % Pref. .. .. .. | 5 | 6 | 6 | 4⅜ — 5¼ | .. | 5 14 3 |
| Do. 4 % First Mort. Deb. .. | Stock | 4 | 4 | 89 — 92 | .. | 4 7 0 |
| Metropolitan .. .. .. | 5 | 4 | 4† | 3⅞ — 3⅞ | .. | 5 3 3 |
| Do. 4½ % Cum. Pref. .. .. | 5 | 4½ | 4½ | 4⅜ — 4½ | .. | 5 0 0 |
| Do. 4½ % First Mort. Deb. .. | Stock | 4½ | 4½ | 96 — 99 | .. | 4 10 1 |
| Do. 3½ % Mort. Deb. .. .. | Stock | 3½ | 3½ | 79 — 82 | +1 | 4 5 4 |
| North Metropolitan Power Supply, 5 % Mortgages (Red.) | 100 | 5 | 5 | 98 —101 | .. | 4 19 0 |
| Notting Hill, 6 % Non-Cum. Pref. | 10 | 6 | 6 | 9⅜ — 10⅜ | .. | 5 11 7 |
| Oxford .. .. .. .. .. | 5 | 7 | 6† | 5⅞ — 6⅜ | .. | 5 9 10 |
| St. James' and Pall Mall, Ord. | 5 | 10 | 10† | 8⅞ — 9⅛ | .. | 5 8 1 |
| Do. 7 % Pref. .. .. .. | 5 | 7 | 7 | 6⅞ — 7 | .. | 5 0 0 |
| Do. 3½ % Deb. .. .. .. | 100 | 3½ | 3½ | 83½ — 85½ | .. | 4 1 10 |
| South-London, Ord. .. .. | 4 | 5½ | .. | 2⅜ — 2½ | .. | 6 15 4 |
| Do. 5 % First Mort. Deb. .. | 100 | 5 | 5 | 96 — 99 | .. | 5 1 0 |
| South Metropolitan, 7 % Pref... | 1 | 7 | 7 | 1⅜ — 1⅝ | .. | 6 1 3 |
| Do. 4½ % First Deb. Stock .. | 100 | 4½ | 4½ | 96 — 99 | .. | 4 10 6 |
| Urban, Ord... .. .. .. | £3 | Nil | .. | ½ — ⅝ | .. | .. |
| Do. 5 % Cum. Pref. .. .. | 5 | 3 | .. | 2⅜ — 2⅝ | .. | .. |
| Do. 4½ % First Mort. Deb. .. | 100 | 4½ | 4½ | 85 — 88 | .. | 5 2 3 |
| Westminster, Ord. .. .. | 5 | 10 | 10† | 9 — 9½ | + ¼ | 5 5 3 |
| Do. 4½ % Cum. Pref. .. .. | 5 | 4½ | 4½ | 4⅛ — 5¼ | .. | 4 5 9 |

## COLONIAL AND FOREIGN ELECTRICITY SUPPLY AND POWER.

| NAME. | Stock or Share. | Dividends for 1912. | Dividends for 1913. | Closing Quotations Sept. 23rd. | Rise + or Fall — | Present Yield p.c. £ s. d. |
|---|---|---|---|---|---|---|
| Adelaide, 6 % Pref. .. .. | 5 | 6 | 6† | 4⅞ — 5⅛ | .. | 5 17 1 |
| Calcutta, Ord. .. .. .. | 5 | 8⅝ | .. | 7 — 7⅜ | .. | 5 18 4 |
| Do. 5 % Pref. .. .. .. | 5 | 5 | 5 | 4⅞ — 5⅛ | .. | 4 17 6 |
| Calgary Power, 1st Mort. Bds. | 100 | 5 | 5 | 91 — 93 | .. | 5 7 6 |
| Canadian Gen. El. Com. .. | $100 | 7 | 7† | 118 —117 | .. | 5 19 8 |
| Do. 7 % Pref. .. .. .. | $100 | 7 | 7 | 119 —124 | .. | 5 12 11 |
| Cordoba Lt., Power and T., Ord. | 1 | 5 | .. | ⅜ — ⅛ | .. | 6 3 1 |
| Do. 5 % Deb. .. .. .. | 100 | 5 | 5 | 93¼ — 95½ | .. | 5 4 9 |
| Elec. Lt. and P. of Cochabamba, 8 % Bonds | 100 | 6 | 6 | 92 — 94 | .. | 6 7 8 |
| Elec. Supply Victoria, 6 % 1st Mort. Deb. | 100 | 5 | 5 | 87½ — 90½ | .. | 5 10 6 |
| Elec. Dev. Ontario, 5 % 1st Mort. Bonds | $500 | 5 | 5 | 92 — 94 | +1½ | 5 6 5 |
| Kalgoorlie Elec. P. and L., Ord. | 10/- | Nil | .. | ⅛ — ⅜ | .. | Nil |
| Do. 6 % Pref. .. .. .. | 1 | 6 | .. | ⅜ — ⅝ | .. | 10 18 4 |
| Kaministiquia Power, 5 % G. Bs. | $500 | 5 | 5 | 102 —104 | .. | 4 16 2 |
| Madras, Ord. .. .. .. | 5 | Nil | .. | 1½ — 1⅝ | .. | .. |
| Melbourne, 5 % 1st Mort. Deb. | 100 | 5 | | 103 —106 | .. | 4 14 4 |
| Mexican El. Lt., 5 % 1st M. Bds. | .. | 5 | 5 | 78 — 82 | .. | 6 1 11 |
| Mexican Lt. & Power, Common | $100 | 4 | 4 | 66 — 70 | .. | 5 14 4 |
| Do. 7 % Cum. Pref. .. .. | $100 | 7 | 7 | 97½—102½ | .. | 6 16 7 |
| Do. 5 % 1st Mort. Gold Bds. | .. | 5 | 5 | 91 — 93 | .. | 5 7 6 |
| Do. 5 % 2nd Mort. Bonds .. | 100 | 5 | 5 | 78 — 80 | .. | 6 5 0 |
| Monterey Rly. Light & Power, 5 % 1st Mort. Deb. | 100 | 5 | 5 | 72 — 76 | —1½ | 6 11 7 |
| Montreal, Lt., H. and Power .. | $100 | 9 | 10† | 215 —225 | .. | 4 0 0 |
| Northern, Lt., Power and Coal, 5 % 1st Mort. Bonds | $500 | 5a | 5a | 15 — 25 | .. | .. |
| River Plate, Ord. .. .. .. | Stock | 10 | .. | 207 —217 | .. | 4 8 0 |
| Do. 6 % Non-Cum. Pref. .. | Do. | 6 | 6 | 102 —107 | .. | 5 9 1 |
| Do. 5 % Deb. Stock .. .. | Do. | 5 | 5 | 97½ — 99½ | .. | 4 19 6 |
| Roy. Elec. Co., Montreal, 4½ % 1st Mort. Deb. | 100 | 4½ | 4½ | 101 —103 | .. | 4 7 5 |
| Shawinigan Water, Capital .. | $100 | 5½ | 6† | 140 —144 | .. | 3 16 5 |
| Do. 5 % Con. 1st Mort. Bonds | $500 | 5 | 5 | 105½—107½ | .. | 4 18 0 |
| Do. 4½ % Per. Deb. .. .. | Stock | 4½ | 4½ | 100⅝—102½ | .. | 4 7 10 |
| Toronto Power, 4½ % Deb. .. | Do. | 4½ | 4½ | 97 —100 | .. | 4 10 0 |
| Vera Cruz Lt., P. and T., 5 % 1st Mort. Deb. | 100 | 5 | 5 | 90½ — 93½ | .. | 5 8 1 |
| Victoria Falls Power, Pref. .. | 1 | 6 | 6 | ⅜ — ⅞ | .. | 6 17 2 |
| West Kootenay Power and Lt., 1st Mort. 6 % Gold | 100 | 6 | 6 | 108 —105 | .. | 5 14 3 |

## TELEGRAPH AND TELEPHONE COMPANIES.

| NAME. | Stock or Share. | Dividends for 1912. | Dividends for 1913. | Closing Quotations Sept. 23rd. | Rise + or Fall — | Present Yield p.c. £ s. d. |
|---|---|---|---|---|---|---|
| Amazon Telegraph .. .. | 10 | 4½ | .. | 6⅝ — 7⅞ | .. | 6 2 0 |
| Do. 5 % Deb. Red. .. .. | Stock | 5 | 5 | 98 — 95 | —1 | 5 5 3 |
| American Telep. & Teleg., Cap. | $100 | 8 | 8 | 134 —136 | .. | 5 17 8 |
| Do. Collat. Trust .. .. | $1000 | 4 | 4 | 91 — 93 | +1 | 4 6 0 |
| Anglo-American Telegraph .. | Stock | 3 | 3 | 62 — 65 | .. | 4 12 4 |
| Do. 6 % Pref. .. .. .. | Do. | 6 | 6 | 105¾—106¾ | — ⅛ | 5 12 8 |
| Do. Def. .. .. .. .. | Do. | 80/- | .. | 28 — 29½ | .. | 6 7 8 |
| Anglo-Portuguese Tel., 5 % Mort. Deb. | 100 | 5 | 5 | 102 —104 | .. | 4 16 2 |
| Chili Telephone .. .. .. | 5 | 8 | .. | 7⅝ — 7⅞ | —1⅛ | 5 5 7 |
| Commercial Cable, Stlg. 4% Deb. | Stock | 4 | 4 | 81½ — 85½ | .. | 4 15 10 |
| Cuba Telegraph .. .. .. | 10 | 6 | 6† | 8¼ — 9½ | .. | 6 9 9 |
| Do. 10 % Pref. .. .. .. | 10 | 10 | 10 | 14½ — 15½ | .. | 6 9 0 |
| Direct Spanish Telegraph, Ord. | 5 | 4 | 4 | 8¼ — 8½ | .. | 5 8 8 |
| Do. 10 % Cum. Pref. .. .. | 5 | 10 | .. | 6¾ — 7½ | .. | 6 12 0 |
| Direct United States Cable .. | 10 | 4 | 4† | 6⅝ — 7⅛ | .. | 5 12 3 |
| Direct W. India Cable, 4½ % Reg. Deb. | 100 | 4½ | 4½ | 98 —100 | .. | 4 10 0 |
| Eastern Telegraph, Ord. Stock | Stock | 7 | 7 | 127½—130½ | + ½ | 5 7 3 |
| Do. 3½ % Pref. Stock.. .. | Do. | 3½ | 3½ | 75 — 77 | .. | 4 10 11 |
| Do. 4 % Mort. Deb. .. .. | Do. | 4 | 4 | 95 — 97 | .. | 4 2 6 |
| Eastern Extension .. .. | 10 | 7 | 7 | 12½ — 13 | .. | 5 7 8 |
| Do. 4 % Deb. .. .. .. | Stock | 4 | 4 | 93 — 95 | +1 | 4 4 3 |
| East and S. Africa Tel. 4 % Mt. Db. Mauritius Sub. | 25 | 4 | 4 | 99 —101 | .. | 3 19 3 |
| Globe Telegraph and Trust .. | 10 | 6 | 6† | 11 — 11½ | .. | 5 4 4 |
| Do. 8 % Pref. .. .. .. | 10 | 6 | 6 | 12⅛ — 12⅝ | + ⅛ | 4 15 1 |
| Great Northern Telegraph .. | 10 | 20 | 5† | 30½ — 32½ | .. | 6 3 1 |
| Indo-European Telegraph .. | 25 | 13 | .. | 57 — 59 | +1 | 5 10 2 |
| Mackay Companies Common .. | $100 | 5 | 5 | 82 — 85 | —3 | 5 17 8 |
| Do. 4 % Cum. Pref. .. .. | $100 | 4 | 4 | 68 — 71 | +1½ | 5 12 8 |
| Marconi's Wireless Telegraph | 1 | 20 | .. | 3⅞ — 4 | — ⅛ | 5 0 0 |
| Do. 7 % Cum. Partic. Pref. | 1 | 17 | .. | 3½ — 3⅝ | —⅛ | 5 0 9 |
| Monte Video Telephone, Ord. .. | 1 | 6 | 6 | 1⅝ — 1⅞ | .. | 5 13 0 |
| Do. 5 % Pref. .. .. .. | 1 | 5 | 5 | ⅝ — ¾ | .. | 5 14 3 |
| New York Telep., 4½ % Gen. Bnds. | 100 | 4½ | 4½ | 99½ —100½ | — ¼ | 4 9 4 |
| Oriental Telep. and Elec. .. | 1 | 10 | .. | 13⅝ — 13¾ | .. | 5 8 6 |
| Do. 6 % Cum. Pref. .. .. | 1 | 6 | 6 | 1⅝ — 1¾ | .. | 4 16 0 |
| Do. 4 % Red. Deb. .. .. | Stock | 4 | 4 | 86 — 88 | .. | 4 10 11 |
| Pacific and European Tel., 4 % Guar. Debs. | Do. | 4 | 4 | 96½ — 98½ | .. | 4 1 3 |
| Reuter's .. .. .. .. | 10 | 10 | 10† | 9⅜ — 10½ | .. | 9 17 6 |
| Submarine Cables Trust .. | Cert. | 6 | 6 | 124 —127 | .. | 4 14 6 |
| Telephone Co. of Egypt, 4½ % Deb. Red. | Stock | 4½ | 4½ | 95 — 97 | .. | 4 12 9 |
| United River Plate Telephone Do. 5 % Cum. Pref. .. .. | 5 | 8 | 6† | 6¾ — 7 | .. | 5 14 4 |
| West Coast of America .. .. | 5 | 5 | 5 | 5 — 5½ | .. | 4 11 0 |
| Do. 4 % Debs., 1 to 500 guar. by Bras. Sub. Tel. | 2½ | 2½ | .. | 1⅞ — 1⅞ | .. | 4 3 4 |
| West India and Panama Teleg. | 100 | 4 | 4 | 94 — 97 | .. | 4 2 6 |
| Do. 6 % Cum. 1st Pref. .. | 10 | 1½ | .. | 2⅜ — 2⅞ | .. | 4 6 11 |
| Do. 6 % Cum. 2nd Pref. .. | 10 | 6 | 6 | 9⅝ — 10⅜ | .. | 5 18 5 |
| Do. 5 % Debs. .. .. .. | 10 | 6 | 6 | 9 — 9¼ | .. | 6 6 4 |
| Western Telegraph, Ltd. .. | 100 | 5 | 5 | 99 —101 | .. | 4 19 0 |
| Do. 4 % Deb. .. .. .. | 10 | 7† | 7 | 12⅜ — 13½ | .. | 5 5 8 |
| Western Union 4½ % Fdg. Bonds | Stock | 4 | 4 | 91 — 93 | .. | 4 6 0 |
| | $1000 | 4½ | 4½ | 92 — 95 | .. | 4 14 9 |

*Unless otherwise stated, all shares are fully paid. a Paid in deferred interest warrants. † Interim Dividend. 8s. in Funded Dividend Cert.

Continued on next Page.

## SHARE LIST OF ELECTRICAL COMPANIES.—(*Continued.*)

### ELECTRIC RAILWAYS AND TRAMWAYS.—HOME.

| NAME. | Stock or Share. | Dividends for 1912. | Dividends for 1913. | Closing Quotations Sept. 23rd. | Rise + or Fall — | Present Yield p.c. |
|---|---|---|---|---|---|---|
| | * | | | | | £ s. d. |
| Bath Trams, Pref. Ord. .. .. | 1 | Nil | .. | ⅜ — ⅝ | .. | Nil |
| Do. 5 % Pref. .. .. .. | 1 | 5 | 5 | 8⅝ — ⅞ | .. | 6 8 0 |
| Do. 4½ % Deb. .. .. .. | 100 | 4½ | 4½ | 72 — 77 | .. | 5 17 0 |
| Brit. Elec. Trac., 6 % Pref. .. | 100 | .. | .. | 12 — 14 | + ¾ | .. |
| Do. Do. Deferred .. | 100 | .. | .. | 4½ — 6 | .. | .. |
| Do. Do. 6 % Cum. Pr't | 100 | 6 | 6 | 86 — 89 | .. | 6 14 10 |
| Do. 7 % Non-Cum. Pr't. | 100 | 3 | .. | 48 — 51 | .. | 5 17 8 |
| Do. 5 % Perp. Deb. .. | 100 | 5 | 5 | 94 — 97 | + ½ | 5 8 1 |
| Do. 4½ % 2nd Deb. .. | 100 | 4½ | 4½ | 76 — 79 | .. | 5 14 0 |
| Central London Railway, Ord. | 100 | 3 | 3 | 78 — 75 | .. | 4 0 0 |
| Do. Gtd. Assented .. .. | 100 | .. | 4 | 79 — 81 | —1 | 4 18 9 |
| Do. Pref. .. .. .. | 100 | 4 | 4 | 77 — 79 | .. | 5 1 3 |
| Do. Gtd. Assented .. .. | 100 | .. | 4 | 81 — 83 | .. | 4 16 3 |
| Do. Def. .. .. .. .. | 100 | 2 | .. | 75 — 77 | .. | 2 12 0 |
| Do. Gtd. Assented .. .. | 100 | .. | 4 | 79 — 81 | .. | 4 18 9 |
| Do. 4 % Deb. .. .. .. | 100 | 4 | 4 | 97 — 99 | .. | 4 0 10 |
| City & S. London, 5 % Pref., 1891 | 100 | 5 | 5 | 98 —100 | .. | 5 0 0 |
| Do. Do. 1896 .. .. | 100 | 5 | 5 | 98 —100 | .. | 5 0 0 |
| Do. Do. 1901 .. .. | 100 | 5 | 5 | 97 — 99 | .. | 5 1 0 |
| Do. Do. 1908 .. .. | 100 | 5 | 5 | 97 — 99 | .. | 5 1 9 |
| Do. 4 % Deb. .. .. .. | 100 | 4 | .. | 93 — 95 | .. | 4 4 8 |
| Hastings Trams, 6 % Pref. .. | 1 | 6 | 6† | ⅛ — ⅜ | .. | 7 18 7 |
| Do. 4½ % Deb. .. .. .. | 100 | 4½ | 4½ | 6¾ — 7⅜ | .. | 6 8 8 |
| Isle of Thanet Trams, 5 % Pref. | 5 | 2½ | .. | 2 5/16 — 2 5/16 | — 1/16 | 4 17 7 |
| Do. 4 % Deb. .. .. .. | 100 | 4 | 4 | 73 — 78 | .. | 5 2 7 |
| Lancashire United, 5 % Deb. .. | 100 | 5 | 5 | 76 — 78 | .. | 6 8 2 |
| London and Suburban, Ord. .. | 1 | .. | .. | ⅛ — ⅜ | .. | .. |
| Do. Do. 5 % Cum. Pref. | 1 | .. | 5† | 5/16 — 7/16 | .. | .. |
| Do. Do. 4½ % 1st. Deb. | 100 | 4½ | 4½ | 74 — 79 | .. | 5 13 11 |

| NAME. | Stock or Share. | Dividends for 1912. | Dividends for 1913. | Closing Quotations Sept. 23rd. | Rise + or Fall — | Present Yield p.c. |
|---|---|---|---|---|---|---|
| | * | | | | | £ s. d. |
| London Elec. Railw'ys, 4 % Deb. | 100 | 4 | 4 | 91 — 93 | .. | 4 6 0 |
| London United Trams, 4 % Deb. | 100 | 4 | 4 | 61 — 65 | .. | 6 3 1 |
| Metropolitan Railway Consol. .. | 100 | 1⅝ | 1½† | 47 — 47½ | +1½ | 3 10 8 |
| Do. Surplus Lands .. .. | 100 | 2½ | 2½† | 59 — 61 | .. | 4 10 2 |
| Do. 3½ % Deb. .. .. .. | 100 | 3½ | 3½ | 83 — 85 | .. | 4 2 4 |
| Do. 3½ % Pref. .. .. .. | 100 | 3½ | 3½ | 77 — 79 | —1 | 4 8 7 |
| Do. 3½ % Con. Pref. .. .. | 100 | 3½ | 3½ | 77 — 79 | .. | 4 8 7 |
| Metropolitan District Ord. .. | 100 | Nil | .. | 84⅜ — 84⅝ | + ¼ | Nil |
| Do. 6 % Deb. .. .. .. | 100 | 6 | 6 | 136 —139 | .. | 4 6 4 |
| Do. 4 % Deb. .. .. .. | 100 | 4 | 4 | 92 — 94 | .. | 4 5 6 |
| Do. 4 % Prior Lien .. .. | 100 | 4 | 4 | 95 — 97 | .. | 4 2 6 |
| Do. 4½ % First Pref. .. .. | 100 | 4½ | 4½ | 82 — 84 | .. | 5 7 4 |
| Do. 3½ % Gtd. .. .. .. | 100 | 3½ | 3½ | 74 — 76 | .. | 4 12 1 |
| Metro. Elec. Trams, 4½ % Deb. | 100 | 4½ | 4½ | 82 — 86 | —2 | 5 4 8 |
| Do. 5 % Deb. .. .. .. | 100 | 5 | 5 | 89 — 93 | .. | 5 8 8 |
| Potteries, Ord. .. .. .. | 1 | 3½ | .. | 3/16 — 5/16 | .. | .. |
| Do. 5 % Pref. .. .. .. | 1 | 5 | 5 | 1/16 — 1/8 | .. | 7 5 6 |
| Do. 4½ % Deb. .. .. .. | 100 | 4½ | 4½ | 82 — 85 | .. | 5 6 5 |
| South Metro. Trams, 6 % Pref. | 1 | 6 | 6† | ⅜ — ½ | .. | 8 0 0 |
| Do. 4 % Deb. .. .. .. | 100 | 4 | 4 | 68 — 72 | .. | 5 11 1 |
| Underground Elec. Railways | 10 | .. | .. | 8⅞ — 4⅛ | + ⅛ | Nil |
| Do. "A" | 1/- | .. | .. | 7/16 — 9/16 | — 1/32 | Nil |
| Do. 6% First Cum. Inc. Deb. | 100 | 6 | 6 | 109 —111 | .. | 5 8 1 |
| Do. 4½ % Bonds .. .. | 100 | 4½ | 4½ | 99 —101 | .. | 4 9 1 |
| Do. 6 % Income .. .. | 100 | 6 | 6 | 91 — 92 | +1½ | 6 1 5 |
| Yorkshire (West Riding), Ord. | 5 | Nil | .. | ⅛ — ⅜ | .. | Nil |
| Do. 6 % Pref. .. .. .. | 5 | 6 | 1½† | 8⅜ — 8⅝ | .. | .. |
| Do. 4½ % Deb. .. .. .. | 100 | 4½ | 4½ | 81 — 85 | .. | 5 6 0 |

### ELECTRICAL RAILWAYS AND TRAMWAYS.—COLONIAL AND FOREIGN.

| | | | | | | |
|---|---|---|---|---|---|---|
| Anglo-Arg. Trams, 1st Pref. .. | 5 | 5½ | 5⅜ | 4⅛ — 4⅜ | .. | 5 11 4 |
| Do. 2nd Pref. .. .. .. | 5 | 5½ | 5⅜ | 4⅜ — 4⅝ | .. | 5 18 11 |
| Do. 4 % Deb. .. .. .. | 100 | 4 | 4 | 92 — 94 | .. | 4 5 1 |
| Do. 4½ % Deb. .. .. .. | 100 | 4½ | 4½ | 96 — 98 | .. | 4 11 10 |
| Do. 5 % Deb. .. .. .. | 100 | 5 | 5 | 98½ — 100½ | .. | 4 19 6 |
| Auckland Trams, 5 % Deb. .. | 100 | 5 | 5 | 100 —102 | .. | 4 18 0 |
| Bombay Elec. S. & Trams, Pref. | 10 | 6 | 6 | 10¾ - 11⅛ | .. | 5 4 4 |
| Do. 4½ % Deb. .. .. .. | 100 | 4½ | 4½ | 94 — 96 | .. | 4 13 9 |
| Do. 5 % 2nd Deb. .. .. | 100 | 5 | 5 | 96 — 99 | .. | 5 1 0 |
| Brazilian Traction Light and Power | $100 | 6 | 6† | 97⅛ — 98⅛ | +1⅛ | 6 1 10 |
| Brisbane Trams Invt., Ord. .. | 5 | 8 | 8† | 7⅞ — 7⅞ | .. | 5 5 0 |
| Do. 5 % Pref. .. .. .. | 5 | 5 | 5 | 4⅞ — 5⅛ | .. | 4 8 11 |
| Do. 4½ % Deb. .. .. .. | 100 | 4½ | 4½ | 99 —102 | .. | 4 8 3 |
| B. Columbia Elec. Rly., Def. .. | 100 | 8 | 8† | 126 —129 | +1 | 6 4 0 |
| Do. Pref. Ord. .. .. .. | 100 | 6 | 6 | 113 —116 | .. | 5 3 5 |
| Do. 5 % Pref. .. .. .. | 100 | 5 | 5 | 103 —106 | + ½ | 4 14 4 |
| Do. 4½ % 1st Mort. Deb. .. | 40 | 4½ | 4½ | 100 —103 | .. | 4 7 5 |
| Do. 4½ % Vancouver Deb. .. | 100 | 4½ | 4½ | 100 —102 | .. | 4 8 8 |
| Do. 4½ % Con. Deb. .. .. | 100 | 4½ | 4½ | 94 — 96 | + ½ | 4 8 7 |
| Calcutta Trams, Ord. .. .. | 5 | 7½ | .. | 5⅝ — 6⅛ | .. | 5 12 0 |
| Do. 5 % Pref. .. .. .. | 5 | 5 | 5 | 4⅞ — 5⅛ | .. | 4 17 7 |
| Do. 4½ % Deb. .. .. .. | 100 | 4½ | 4½ | 96 — 99 | .. | 4 11 0 |
| Cape Electric Trams .. .. | 1 | 5 | .. | 1⅛ — 1⅜ | .. | 6 8 1 |
| City Buenos Aires Trams (1904) | 5 | 5† | 5 | 5⅝ — 5⅞ | .. | 4 9 11 |
| Do. 4 % Deb. .. .. .. | 100 | 4 | 4 | 92 — 97 | .. | 4 2 6 |
| Colombo Elec. Tr. & Lt., 5 % Deb. | 100 | 5 | 5 | 90½ — 94½ | .. | 5 5 10 |
| Havana Elec. Rly., 5 % Bonds | $1000 | 5 | 5 | 94½ — 98½ | .. | 5 1 6 |
| Kalgoorlie Elec. Trams .. .. | 1 | Nil | .. | 1/16 — 3/16 | .. | Nil |
| Do. 5 % A Deb. .. .. | 100 | 5 | 5 | 85 — 90 | .. | 5 11 1 |
| Do. 6 % B Deb. .. .. | 100 | 3 | .. | 25 — 35 | .. | .. |

| | | | | | | |
|---|---|---|---|---|---|---|
| La Plata Elec. Trms, Ord. .. | 1 | .. | .. | 13/16 — 17/16 | .. | .. |
| Do. Pref. .. .. .. | 1 | 4⅝d. | 6 | 33/16 — 1 5/16 | .. | 5 16 6 |
| Lisbon Elec. Trams, Ord. .. | 1 | 6 | 6† | 1 — 1⅛ | —3/32 | 4 16 0 |
| Do. 6 % Pref. .. .. .. | 1 | 6 | 6 | 1 5/16 — 1 7/16 | —1/16 | 5 1 1 |
| Do. 5 % Deb. .. .. .. | 100 | 5 | 5 | 91 — 96 | .. | 5 4 2 |
| Madras Elec. Tr. 6% Cum. Pref. | 5 | 6 | 6 | 4⅞ — 5⅛ | .. | 5 17 1 |
| „ Elec. Tr. (1904), Deb. .. | 100 | 5 | 5 | 101 —103 | .. | 4 17 1 |
| Manaos Trams & Lt., 1st Deb. .. | 100 | 5 | 5 | 87 — 89 | .. | 5 12 4 |
| Manila Elec. R. and Ltg., Bonds | $1000 | 5 | 5 | 97 — 99 | .. | 5 1 0 |
| Mexico Trams Com. .. .. | $100 | 7† | 7 | 97⅛ — 99⅛ | — 1 | 7 0 8 |
| Do. Gen. Con. 5 % Bonds .. | .. | 5 | 5 | 91 — 93 | + ½ | 5 7 6 |
| Do. 6 % Bonds .. .. .. | 100 | 6 | 6 | 93½ — 95½ | .. | 6 5 8 |
| Para Elec. Rlys. & Lt., Ord. .. | 5 | 10 | 10† | 6 — 6⅛ | .. | 7 18 10 |
| Do. 6 % Pref. .. .. .. | 5 | 6 | 6 | 4⅞ — 5⅛ | .. | 5 17 1 |
| Do. 5 % 1st Deb. .. .. | 100 | 5 | 5 | 98½ —100½ | .. | 4 19 6 |
| Perth (W.A.) Elec. Tr., Ord. .. | 1 | 5½ | .. | 1⅜ — 1⅝ | .. | 4 0 0 |
| Rangoon El. Tr. & Sup., Pref. .. | 5 | 6 | 6 | 5 — 5½ | .. | 5 9 1 |
| Do. 4½ % 1st Deb. .. .. | 100 | 4½ | 4½ | 95 — 97 | .. | 4 12 9 |
| Rio de Janeiro Trams, 1st Mort. 5 % Bonds | .. | 5 | 5 | 102½ —103½ | + ½ | 4 16 10 |
| Do. 5 % Mort. Bonds .. | 100 | 5 | 5 | 97 — 98 | + ½ | 5 2 0 |
| Sao Paulo Tram, Lt. and P. 5 % 1st Deb. | $500 | 5 | 5 | 102½ — 104½ | + ½ | 4 15 8 |
| Singapore Trams, 5 % Deb. .. | 100 | 5 | 5 | 85 — 89 | .. | 5 12 4 |
| Southern El. Tr. B.A., 5 % Deb. | 100 | 5 | 5 | 93 — 95 | .. | 5 5 3 |
| Un. Elec. Trams Monte Video .. | 5 | 7 | 7 | 4⅝ — 5 | .. | 7 0 0 |
| Do. 6 % Pref. .. .. .. | 5 | 6 | 6 | 4 3/16 — 5 1/16 | .. | 5 18 7 |
| Do. 5 % 1st Deb. .. .. | 100 | 5 | 5 | 97 —100 | .. | 5 0 0 |
| Winnipeg Elec. Rly., 4½ % Deb. | 100 | 4½ | 4½ | 98½ —100½ xd | .. | 4 9 7 |

### MANUFACTURING COMPANIES.

| | | | | | | |
|---|---|---|---|---|---|---|
| Aron, Ord. .. .. .. .. | 1 | 7 | .. | 9/16 — 13/16 | .. | 8 12 4 |
| Do. 6 % Pref. .. .. .. | 1 | 6 | 6 | 13/16 — 15/16 | —1/16 | 7 13 4 |
| Babcock & Wilcox .. .. | 1 | 16 | .. | 8 1/16 — 8 3/16 | .. | 5 0 5 |
| Do. Pref. .. .. .. | 1 | 6 | 6 | 1 1/16 — 1 3/16 | .. | 4 3 6 |
| British Aluminium, Ord. .. .. | 1 | .. | .. | 1 3/16 — 1 5/16 | —1/16 | .. |
| Do. 6 % Cum. Pref. .. .. | 1 | 6 | 6 | 1 1/16 — 1 1/8 | .. | 6 8 0 |
| Do. 5 % Prior Lien Debs. .. | 100 | 5 | 5 | 92 — 95 | .. | 5 5 3 |
| Do. Deb. Stk. .. .. .. | 100 | 5 | 5 | 83 — 86 | .. | 5 16 8 |
| B. I. & Helsby Cables .. .. | 5 | 10 | .. | 8⅛ — 8⅜ | .. | 5 14 3 |
| Do. Pref. .. .. .. .. | 5 | 6 | 6 | 5⅞ — 6⅛ | .. | 4 16 0 |
| Do. Deb. .. .. .. .. | 100 | 4½ | 4½ | 99 —102 | .. | 4 8 3 |
| British Thomson-Houston, Deb. | 100 | 4½ | 4½ | 93½ — 96½ | .. | 4 14 0 |
| British Westinghouse, Pref. .. | 5 | Nil | .. | 1⅛ — 1⅜ | + 1/16 | Nil |
| Do. Deb. .. .. .. .. | 100 | 4 | 4 | 66 — 69 | .. | 5 15 11 |
| Do. 6 % Prior Lien .. .. | 100 | 6 | 6 | 101 —104 | .. | 5 15 5 |
| Brownett, Lindley, Ord. .. .. | 1 | .. | .. | 2/- — 3/- | .. | Nil |
| Do. Pref. .. .. .. | 1 | .. | .. | 8/- — 8/6 | .. | Nil |
| Brush, 7 % Pref. .. .. .. | 2 | Nil | .. | 0 — ½ | .. | Nil |
| Do. 5 % Prior Lien Deb. .. | 100 | 5 | 5 | 70½ — 75½ | .. | 6 12 5 |
| Do. 4½ % Deb .. .. .. | 100 | 4½ | 4½ | 85½ — 40½ | .. | 11 2 2 |
| Do. 4½ % Second Deb. .. .. | 100 | 4½ | 4½ | 23 — 27 | .. | 16 13 4 |
| Callender's Cable .. .. .. | 5 | 15 | .. | 11 — 11⅞ | + ⅛ | 6 7 8 |
| Do. Pref. .. .. .. | 5 | 5 | 5 | 4⅞ — 5 1/16 | .. | 4 18 9 |
| Do. Deb. .. .. .. .. | 100 | 4½ | 4½ | 96 — 99 | .. | 4 10 6 |
| Castner-Kellner .. .. .. | 1 | 20 | .. | 8⅜ — 8⅞ | .. | 5 8 2 |
| Do. Deb. .. .. .. .. | 100 | 4½ | 4½ | 102 —105 | .. | 4 5 9 |

| | | | | | | |
|---|---|---|---|---|---|---|
| Crompton & Co., Deb. .. .. | 100 | 5 | .. | 54½ — 59½ | .. | 8 8 0 |
| Dick, Kerr .. .. .. .. | 1 | Nil | .. | 1/16 — 3/16 | .. | .. |
| Do. Pref. .. .. .. .. | 1 | 6 | 6 | 3/16 — 5/16 | .. | 7 13 10 |
| Edison & Swan, A, £8 paid .. | 5 | Nil | .. | 0 — ⅛ | .. | Nil |
| Do. fully paid .. .. .. | 5 | Nil | .. | 1⅛ — 1⅜ | .. | Nil |
| Do. 4 % Deb. .. .. .. | 100 | 4 | 4 | 68 — 62 | .. | 6 9 1 |
| Do. 5 % Second Deb. .. .. | 100 | 5 | 5 | 65 — 70 | .. | 7 2 10 |
| Electric Construction .. .. | 2 | 5 | .. | 1 — 1½ | .. | 8 0 0 |
| Do. Pref. .. .. .. .. | 2 | 7 | 7 | 1⅞ — 2⅛ | + 1/16 | 6 11 9 |
| Greenwood & Batley, Pref. .. | 10 | 7 | 7 | 6⅞ — 7½ | .. | 9 13 2 |
| Do. Deb. .. .. .. .. | 100 | 5 | .. | 92 — 94 | .. | 5 4 2 |
| General Electric, 6% Pref. .. | 10 | 6 | 6 | 9⅛ — 10½ | .. | 6 14 8 |
| Do. Deb. .. .. .. .. | 100 | 4 | 4 | 89 — 94 | .. | 4 5 1 |
| Henley's, Ord. .. .. .. | 5 | 15 | 10† | 12½ — 13 | .. | 5 15 5 |
| Do. Pref. .. .. .. .. | 5 | 4½ | 4½ | 4 15/16 — 5⅛ | .. | 4 8 11 |
| Do. Deb. .. .. .. .. | 100 | 4½ | 4½ | 101 —103 | .. | 4 7 5 |
| India-Rubber, G. & T. .. .. | 10 | 7½ | .. | 12⅜ — 13⅜ | .. | 5 9 1 |
| Do. Pref. .. .. .. .. | 10 | 5 | 5 | 9⅜ — 10⅛ | .. | 4 18 9 |
| Telegraph Construction .. .. | 12 | 20 | 5† | 87 — 89 | .. | 6 3 1 |
| Do. Deb. .. .. .. .. | 100 | 4 | 4 | 96 — 98 | .. | 4 1 8 |
| Willans & Robinson .. .. | 100 | 4 | 4 | 55 — 60 | +1 | 6 13 4 |

* Unless otherwise stated all shares are fully paid. † Interim dividend.

Bank rate of Discount 4½ per cent., April 17th, 1913.

# EXPORTS AND IMPORTS OF ELECTRICAL GOODS DURING AUGUST, 1913.

The electrical exports for August, which are summarised below, show a return approximately to the June level, the figure for July having been abnormally inflated by a large export of telegraph cable; the total exports amounted to £434,226, compared with £660,363 for July. The imports at £216,301 are almost exactly the same as in July, £216,908; and the re-exports have fallen to the exceptionally low value of £17,654, compared with £34,462 in July.

Allowing for the absence of the big telegraphic item, the most noticeable falling off in the exports is still found under the heading of telegraphic cable and apparatus, being in the neighbourhood of £30,000; the telephone section, on the other hand, shows an increase, but batteries are down, and there is a heavy drop in electrically-driven machinery. With these exceptions there is no great difference between the returns for the two months. The imports table, however, shows variations in all the items, although the total is practically unchanged. In particular, glow lamps, electrical goods and electrically-driven machinery have fallen off, while batteries, machinery and meters show substantial gains. Our best customers for the month were again India and New South Wales, with Argentina, Canada and Brazil well to the fore.

## Registered Exports of British and Irish Electrical Goods from the United Kingdom.

| Destination of exports and country consigning imports. | Electrical goods and appliances. | Wires and cables, rubber and other insulations. | Electric lighting fittings and accessories. | Electric glow lamps. | Electric arc lamps and lamp parts. | Electric meters and instruments. | Electric machinery. | Electrically-driven machinery. | Batteries and accumulators. | Carbons. | Telephonic cable and apparatus and electric bells | Telegraphic cable and apparatus. | Total. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | £ | £ | £ | £ | £ | £ | £ | £ | £ | £ | £ | £ | £ |
| Russia, Sweden, Norway and Denmark ... | 1,343 | 611 | 95 | ... | 2,786 | 327 | 5,120 | 256 | ... | 21 | 65 | 313 | 10,937 |
| Germany ... ... ... ... ... | 1,425 | 4,523 | 35 | ... | 594 | 27 | 1,414 | 71 | 196 | 49 | 29 | 274 | 8,641 |
| Netherlands, Java and Dutch Indies ... | 480 | 1,414 | 74 | ... | 35 | 98 | 1,486 | ... | 8 | 51 | 119 | 559 | 4,324 |
| Belgium ... ... ... ... ... | 601 | 364 | 149 | ... | 78 | 9 | 3,630 | 121 | 2 | ... | 1,295 | 365 | 6,614 |
| France ... ... ... ... ... ... | 629 | ... | 3,353 | ... | ... | ... | 2,819 | 259 | 151 | ... | 21 | 1,023 | 8,255 |
| Portugal ... ... ... ... ... | 526 | 115 | ... | 22 | ... | 119 | 325 | ... | 7 | 4 | 120 | 90 | 1,330 |
| Spain, Canary Isles and Spanish N. Africa... | 840 | 656 | 109 | ... | 563 | 39 | 4,987 | ... | 183 | ... | 205 | 110 | 7,692 |
| Switzerland, Italy and Austria-Hungary ... | 336 | 40 | 345 | ... | 22 | 5 | 12,256 | ... | 155 | 148 | 45 | 4,272 | 17,618 |
| Greece, Roumania and Turkey ... ... | 187 | 3,089 | 148 | 54 | 56 | 8 | 215 | ... | 25 | ... | 1,527 | 4,008 | 9,317 |
| Channel Isles, Gibraltar, Malta and Cyprus... | 45 | 50 | 4 | 30 | ... | 11 | 141 | ... | ... | ... | 96 | 633 | 1,010 |
| U.S.A., Philippines and Cuba ... ... | 957 | ... | 38 | 33 | ... | 97 | 4,083 | ... | ... | ... | 74 | 699 | 5,981 |
| Canada and Newfoundland ... ... ... | 1,596 | 4,498 | 690 | 996 | 84 | 2,053 | 7,112 | 280 | 661 | 12 | 4,888 | 5,191 | 28,058 |
| British West Indies and British Guiana ... | 17 | ... | 98 | 61 | 15 | 63 | 730 | 14 | 33 | ... | 77 | 19 | 1,127 |
| Mexico and Central America ... ... | 90 | ... | ... | ... | ... | ... | 964 | ... | ... | ... | ... | ... | 1,054 |
| Peru and Uruguay ... ... ... ... | 692 | 878 | 99 | 325 | 23 | ... | 856 | 89 | 35 | 35 | 226 | 2,541 | 5,799 |
| Chile ... ... ... ... ... ... | 757 | 769 | 376 | 74 | 192 | 245 | 2,776 | 110 | 744 | 22 | 155 | 7,635 | 13,855 |
| Brazil ... ... ... ... ... ... | 1,071 | 1,642 | 1,097 | 224 | ... | 906 | 8,867 | 697 | 415 | 24 | 201 | 12,690 | 27,834 |
| Argentina ... ... ... ... ... | 4,389 | 9,246 | 1,271 | 207 | 60 | 624 | 7,188 | 1,979 | 946 | 177 | 9,416 | 669 | 36,167 |
| Colombia, Venezuela, Ecuador and Bolivia... | 184 | 104 | 19 | 182 | ... | 13 | 1,662 | ... | 918 | ... | 229 | ... | 3,311 |
| Egypt, Tunis and Morocco ... ... ... | 1,682 | 15 | 192 | 11 | ... | ... | 660 | 600 | 35 | 22 | 362 | 487 | 4,063 |
| British West Africa ... ... ... ... | 12 | 596 | 108 | 14 | ... | ... | 501 | ... | 121 | ... | 42 | 175 | 1,569 |
| Rhodesia, O.R.C. and Transvaal ... ... | 2,039 | 1,880 | 463 | 917 | ... | 165 | 2,450 | 44 | 294 | 28 | 12 | 128 | 8,420 |
| Cape of Good Hope ... ... ... ... | 2,271 | 2,664 | 328 | 399 | ... | 303 | 2,363 | 17 | 2,092 | 58 | 160 | 3,982 | 14,637 |
| Natal ... ... ... ... ... ... | 881 | 3,053 | 434 | 226 | 151 | 3 | 3,984 | 83 | 240 | ... | 29 | 4,106 | 13,190 |
| Zanzibar, Brit. E. Africa, Mauritius & Aden | 368 | 69 | 189 | 206 | ... | 50 | 148 | 16 | ... | ... | 8 | 103 | 1,157 |
| Azores, Madeira and Portuguese Africa ... | 288 | 1,067 | 1,023 | 74 | ... | 114 | 1,353 | 31 | 4 | 13 | 99 | 292 | 4,358 |
| French African Colonies and Madagascar ... | 54 | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | 132 | 186 |
| China and Siam ... ... ... ... | 1,441 | 1,833 | 104 | 522 | ... | 936 | 3,793 | 93 | 105 | 32 | 2,199 | 167 | 11,225 |
| Japan and Korea ... ... ... ... | 238 | 856 | 834 | 32 | ... | 559 | 16,825 | 33 | 1,418 | 54 | ... | 960 | 21,809 |
| India ... ... ... ... ... ... | 3,586 | 7,975 | 2,298 | 1,277 | 139 | 1,465 | 19,876 | 4,746 | 1,870 | 238 | 3,437 | 1,485 | 48,392 |
| Ceylon ... ... ... ... ... ... | 388 | 102 | 213 | 47 | 70 | 76 | 76 | 201 | 43 | ... | 170 | 300 | 1,686 |
| Straits Settlements, Fed. Malay States and Sarawak ... ... ... ... | 289 | 2,198 | 521 | 161 | ... | 119 | 2,664 | 19 | 72 | 5 | 340 | 4,664 | 11,052 |
| Hong Kong ... ... ... ... ... | 212 | 1,027 | 126 | 247 | ... | ... | 928 | 19 | 31 | 18 | 44 | 1,250 | 3,902 |
| West Australia ... ... ... ... | 213 | 1,637 | 36 | 402 | ... | 553 | 330 | 24 | 360 | 10 | 26 | 711 | 4,302 |
| South Australia ... ... ... ... | 276 | 1,042 | 280 | 213 | ... | 1 | 680 | ... | 6 | ... | 39 | 573 | 3,110 |
| Victoria ... ... ... ... ... | 1,449 | 7,680 | 1,563 | 1,291 | 837 | 899 | 2,699 | 337 | 1,223 | 15 | 1,154 | 147 | 19,294 |
| New South Wales ... ... ... ... | 1,040 | 10,339 | 760 | 2,155 | 281 | 1,653 | 11,994 | 310 | 456 | 14 | 8,929 | 2,995 | 40,926 |
| Queensland ... ... ... ... ... | 237 | 90 | 250 | 92 | 40 | 556 | 1,108 | 594 | 24 | ... | 30 | ... | 3,031 |
| Tasmania ... ... ... ... ... | 83 | 25 | 65 | ... | ... | ... | 649 | ... | ... | ... | 1,454 | ... | 2,276 |
| New Zealand and Fiji Islands ... ... | 1,022 | 2,701 | 974 | 1,078 | 115 | 4,578 | 412 | 75 | 245 | 80 | 3,756 | 1,681 | 16,717 |
| Total, £ | 34,234 | 74,850 | 18,761 | 11,572 | 6,141 | 16,684 | 140,111 | 11,118 | 13,118 | 1,130 | 41,078 | 65,429 | 434,226 |

## Registered Imports into the United Kingdom of Electrical Goods from all Countries.

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Russia, Norway, Sweden and Denmark ... | 2 | ... | ... | 12 | ... | ... | 6,004 | 75 | 509 | 6 | 5,426 | 12,034 |
| Germany ... ... ... ... ... | 84 | 31,898 | 1,545 | 6,046 | 10,364 | 5,691 | 46,264 | 14 | 3,824 | 8,331 | 8,501 | 122,562 |
| Holland ... ... ... ... ... | ... | 5 | ... | 350 | 653 | ... | 109 | ... | 6 | ... | ... | 1,123 |
| Belgium ... ... ... ... ... | 1,005 | 2,423 | 59 | 174 | ... | ... | 3,711 | ... | 926 | 570 | 11,817 | 20,685 |
| France ... ... ... ... ... | 233 | 300 | 274 | 987 | 177 | 474 | 321 | ... | 659 | 4,008 | 530 | 7,963 |
| Switzerland ... ... ... ... ... | 313 | 1,101 | 26 | 8 | ... | 167 | 1,440 | ... | ... | 89 | 235 | 3,379 |
| Italy ... ... ... ... ... ... | ... | 3,036 | ... | ... | 6 | ... | ... | ... | ... | ... | 159 | 3,201 |
| Austria-Hungary ... ... ... ... | 13 | 160 | ... | 105 | 130 | ... | ... | ... | 323 | 1,265 | 33 | 2,029 |
| United States ... ... ... ... ... | 5,442 | 75 | 624 | ... | 10 | 1,902 | 15,624 | 14,991 | 697 | 548 | 2,682 | 42,595 |
| Total, £ | 7,092 | 38,998 | 2,528 | 7,682 | 11,340 | 8,234 | 73,475 | 15,080 | 6,944 | 14,817 | 29,383 | 215,571 |

Additional imports: Spain, carbons £550; Canada, telegraph and telephone apparatus £65, electrical goods £20, electrical machinery £95.

## Registered Re-Exports of Foreign and Colonial Electrical Goods from the United Kingdom.

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Various countries, mainly as above ... | 9,677 | 529 | ... | 1,203 | 449 | ... | 4,784 | ... | 250 | 197 | 565 | 17,654 |

**Total Exports: £434,226. Total Re-Exports: £17,654. Total Imports: £216,301.**

**Note.—The amounts appearing under the several headings are classified according to the Customs returns. The first and third columns contain many amounts relating to "goods" otherwise unclassified, the latter, doubtless, consisting of similar materials to those appearing in adjacent columns. Imports are credited to the country whence consigned, which is not necessarily the country of origin.**

## APPARATUS ON HIRE.

By T. C. PARSONS.

(*Concluded from page* 476.)

*Account Forms.*—The form of accounts for this purpose got out by the writer for the Govan Corporation was that of a triplicate book. The Electricity Department made out and issued the accounts; a copy of the account was retained in the book, and a copy was sent to the burgh treasurer or accountant who received the money. There was also an alphabetical index in the book, so that any account could be quickly found for reference. This system worked well, and samples of the three leaves are appended.

When the accounts were made out at each quarter, the total amount of each invoice was copied into a ledger and sent up to the treasurer for him to enter the date of payment. The ruling used is given at the bottom of the page.

One double page served for the complete year, the hirer's name and address being in the two centre columns for easy reference to both pages. The account number is the one printed on the top right-hand corner of the triplicate form.

No.

BURGH OF GOVAN ELECTRICITY DEPARTMENT.

HELEN STREET,
GOVAN, ..... 191

*Messrs.* .....

.....

*Dr. to* THE PROVOST, MAGISTRATES AND COUNCILLORS OF THE BURGH OF GOVAN.

*To* Rent now due for Motors and Slide Rails as under:—
For Quarter ending .....

| | | | £ | s. | d. |
|---|---|---|---|---|---|
| Motor of | H.P. at £ | per annum .. Corp. No. ..... | | | |
| Do. | H.P. at £ | do. .. .. .. | | | |
| Do. | H.P. at £ | do. .. .. .. | | | |
| Do. | H.P. at £ | do. .. .. .. | | | |
| Do. | H.P. at £ | do. .. .. .. | | | |
| Sets Slide Rails, | at £ | do. .. .. .. | | | |
| Do. | at £ | do. .. .. .. | | | |
| Do. | at £ | do. .. .. .. | | | |
| Do. | at £ | do. .. .. .. | | | |
| Do. | at £ | do. .. .. .. | | | |
| | | TOTAL .. .. .. £ | | | |

NOTE.—Any inquiry in connection with this Account should be made to the BURGH ELECTRICAL ENGINEER, Electricity Works, Helen Street, within seven days, after which date no question as to the accuracy of same can be entertained.

PAYMENT is requested to be made within ten days to
JOHN RANKIN, Collector, Municipal Buildings, Summertown Road, Govan.

*Office open from 9.30 a.m. to 4.30 p.m. Closed on Saturdays at 1 p.m.*

Please present this Account when Payment is made.

No.

BURGH OF GOVAN ELECTRICITY DEPARTMENT.

HELEN STREET,
GOVAN, ..... 191

*Messrs.* .....

.....

*Dr. to* THE PROVOST, MAGISTRATES AND COUNCILLORS OF THE BURGH OF GOVAN.

*To* Rent now due for Motors and Slide Rails as under:—
For Quarter ending .....

| | | | £ | s. | d. |
|---|---|---|---|---|---|
| Motor of | H.P. at £ | per annum .. Corp. No. ..... | | | |
| Do. | H.P. at £ | do. .. .. .. | | | |
| Do. | H.P. at £ | do. .. .. .. | | | |
| Do. | H.P. at £ | do. .. .. .. | | | |
| Do. | H.P. at £ | do. .. .. .. | | | |
| Sets Slide Rails | at £ | do. .. .. .. | | | |
| Do. | at £ | do. .. .. .. | | | |
| Do. | at £ | do. .. .. .. | | | |
| Do. | at £ | do. .. .. .. | | | |
| Do. | at £ | do. .. .. .. | | | |
| | | TOTAL .. .. .. £ | | | |

The Treasurer will please note that the above Account has been delivered.

### ELECTRIC HEATING.

Whilst electric heating is exceedingly useful for occasional use and for special cases, it cannot, at the present price of current, be put forward as a commercial competitor to the coal fire. To attempt to do so will only bring discredit on electric heating; and if consumers are persuaded to install hired radiators with the idea that they are going to be an economical solution of the domestic fire question, the result will be bad for the hiring department.

It must be remembered, in the first place, that by far the largest proportion of the population must have heat at the lowest cash cost, and convenience cannot possibly enter into their calculations; this will be clearly brought home to everyone when it is remembered that 89 per cent. of the population do not pay direct income-tax, and that therefore their incomes are under £160 per annum.

Electricity has so many other uses, in which it is superior to all competitors, that it is a pity prospective consumers should be misled as to the cost of heating and induced to put in heating appliances, to find in the end that it is a failure on the score of expense.

In order to establish a comparison between the two ways of heating, tests were made in an office of 3,537 cb. ft. and in a private room of 2,831 cb. ft., the results of which were as follows:—

It was considered that the results would be of no value without a record of the temperatures both outside the window and inside the room.

The office had two outside walls, one facing north-west with three windows, each 6 ft. × 3 ft., and the other facing north-east, with no windows. It was heated first by a well fire and then by a 3-unit Bastian heater. Three thermometers were hung up, one at each end and one in the middle of the room, and one was put outside the window. Temperature readings were taken every hour, and the coal and electricity were measured for several days. During the coal-heating tests the weather was considerably colder than during the electric-heating tests:—

HEATING BY COAL FIRE.

| Date, 1911. | Average outside temperature, °F. | Average rise of temperature in room, °F. | Coal. | Cost per day at 20s. per ton. |
|---|---|---|---|---|
| Feb. 1 | 27 | 24·1 | 49 lb. | 5·24d. |
| ,, 2 | 31·8 | 23·1 | 52 ,, | 5·56d. |
| ,, 3 | 31·2 | 18·8 | 44 ,, | 4·71d. |
| ,, 4 | 39·4 | 14·0 | 27 ,, | 2·89d. (Saturday) |
| ,, 6 | 44 | 11·5 | 40 ,, | 4·28d. |
| ,, 7 | 46·3 | 12·5 | 34 ,, | 3·64d. |
| ,, 8 | 41·1 | 16·2 | 33 ,, | 3·53d. |
| ,, 9 | 43 | 14·0 | 34 ,, | 3·64d. |
| ,, 10 | 41·9 | 16·9 | 34 ,, | 3·64d. |
| 76 hours | 38·4 | 16·8 | 347 lb. | 37·13d. |

Ruling of Motor Ledger.—

BURGH OF GOVAN ELECTRICITY DEPARTMENT.

MOTOR RENTS.

| For period ending | | | | | | For period ending | | | | | | Name. | Address. | For period ending | | | | | For period ending | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| No. of Account. | Date of issue. | Amounts. Due. | Amounts. Paid. | Date of payment. | Arrears. | No. of Account. | Date of issue. | Amounts. Due. | Amounts. Paid. | Date of payment. | Arrears. | | | No. of Account. | Date of issue. | Amounts. Due. | Amounts. Paid. | Date of payment. | Arrears. | No. of Account. | Date of issue. | Amounts. Due. | Amounts. Paid. | Date of payment. | Arrears, May 15th. Remarks. |
| | | | | | | | | | | | | | | | | | | | | | | | | | |

The fire was lit at 7.30 a.m. and the temperature readings were taken from 8.30 a.m. to 5.30 p.m. The total number of hours for the period was 76, but, of course, the fire was not right out at 5.30 p.m. The variation of temperature in different parts of the room was very slight, the maximum being 5° F., on February 1st, and the minimum 1° F., on February 9th.

Maximum Variation.—February 1st, 1911.

| Time. | Reading on thermometer. 1. | 2. | 3. | Outside. |
|---|---|---|---|---|
| 10.45 a.m. ... | 48·5 | 51·5 | 46·5 | 28 |
| 12 30 p.m. ... | 49·5 | 50 | 50·5 | 28 |
| 2.30 p.m. ... | 52 | 53·5 | 54·5 | 27 |
| 4 p.m. ... | 52·5 | 57 | 52 | 26 |
| 5.15 p.m. ... | 54 | 55 | 54 | 26 |

Minimum Variation.—February 9th, 1911.

| Time. | Readings on thermometer. 1. | 2. | 3. | Outside. |
|---|---|---|---|---|
| 8.30 a.m. ... | 52 | 52 | 51 | 44 |
| 10.50 a.m. ... | 56 | 57 | 57 | 44 |
| 12.30 p.m. ... | 59 | 60 | 58 | 43 |
| 2.45 p.m. ... | 57·5 | 59 | 61·5 | 42 |
| 5.15 p.m. ... | 58·5 | 59 | 58 | 42 |

In estimating the efficiency of a coal fire, one point is frequently lost sight of, viz., the heat which is given to the brickwork and radiated out again into the room.

In the office in question, the temperature was taken at the entrance to the chimney, sufficiently high up to ensure that the gases had been mixed with the air drawn in from the room, and was found to be 650° F., and at the same time readings at the chimney pot showed 195° F., the difference being 455° F., and the heat represented by this difference of temperature must have been absorbed by the brickwork and a fair proportion radiated out into the room. In the case of a house where the fireplace is in an inside wall, all the heat absorbed by the brickwork in this way is given out into the house.

After these tests a 12-ampere Bastian radiator was installed, and for five days temperature readings were taken in the same way, the results being given below :—

Heating by Electricity.

| Date. | Average temperature outside. | Average rise inside. | Units. | Cost at 1d per unit. |
|---|---|---|---|---|
| Feb. 21 ... | 50·3 | 7 | 21 | 1s. 9d. |
| ,, 22 ... | 39·6 | 16·3 | 28 | 2s. 4d. |
| ,, 23 ... | 45·3 | 12·6 | 29 | 2s. 5d. |
| ,, 24 ... | 45·9 | 9·8 | 26 | 2s. 2d. |
| ,, 25 ... | 44 | 13·0 | 11 | 11d. (Sat.) |
| 40 hours | 45·02 | 11·7 | 115 | 9s. 7d. |

The radiator was on for 23 days from 8.30 a.m. to 5.30 p.m. and for four days from 8.30 a.m. to 12.30 p.m., a total of 223 hours, and during that time 600 units were consumed, an average of 2·69 units per hour.

Since the radiator was first installed the fire has not been lit, and all the heating has been done electrically, and from February 21st, 1911, to November 7th, 1912, 5,708 units were taken, the temperature of the room being usually kept between 55° and 60° F. This practically represents the heating for one and a half seasons, and the cost at 1d. per unit would have been £23 14s. or £15 16s. per annum for one fair-sized room.

The variation of the temperature in different parts of the room was about the same as with coal heating, the maximum being 5·5° F.

Electric Heating.

*Maximum Variation on February 22nd*, 1911.

| Time. | Reading of thermometer. 1. | 2. | 3. | Outside. |
|---|---|---|---|---|
| 8.30 ... ... | 56 | 51 | 50·5 | 42 |
| 9.45 ... ... | 55 | 55·5 | 54·5 | 40 |
| 12.45 ... ... | 57 | 56·5 | 56·5 | 41 |
| 2.45 ... ... | 57 | 57 | 57 | 34 |
| 5.15 ... ... | 58·5 | 58·5 | 58·5 | 41 |

*Maximum Variation on February 24th*, 1911.

| Time. | Readings of thermometer. 1. | 2. | 3. | Outside |
|---|---|---|---|---|
| 8.30 ... ... | 50 | 47 | 47·5 | 40 5 |
| 9.45 ... ... | 54 | 53 | 52 | 42 |
| 11.0 ... ... | 55 | 52 | 52 | 39 |
| 2.40 ... ... | 58·5 | 57·5 | 57 | 46 |
| 3.50 ... ... | 59·5 | 59·5 | 58·5 | 60 |
| 4.45 ... ... | 61 | 62 | 60·5 | 51 |
| 5.25 ... ... | 59 | 57·5 | 58·5 | 43 |

The results in the living room, which were taken in exactly the same way, were—

Coal Firing.

| | |
|---|---|
| Average temperature rise ... ... ... | 13·8° F. |
| Coal burnt ... ... ... ... ... | 61 lb. |
| Total hours ... ... ... ... ... | 28·5 |
| Cost at 20s. per ton ... ... ... ... | 6·53d. |

Electric Heating.

| | |
|---|---|
| Average temperature rise ... ... ... | 9·5° F. |
| Energy consumed ... ... ... ... | 112·5 units. |
| Total time ... ... ... ... ... | 81·6 hours. |
| Cost at 1d. per unit ... ... ... ... | 9s. 4½d. |

Taking the total, the results are—

Office.

347 lb. coal gave an average rise of 16·8° F. for 76 hours.
112 units ,, ,, ,, 11·7° F. ,, 40 ,,

Assuming a direct proportion, there would be required 128 lb. coal to give the same amount of heat for the same time as 115 units, or one unit equals 1·11 lb. coal. Taking the price of coal at 20s. per ton, electricity in order to compete must sell at ·119d. per unit.

Living Room.

61 lb. of coal gave an average rise of 13·8° F. for 28·5 hours.
112·5 units ,, ,, ,, 9·6° F. ,, 81·6 ,,

and assuming a direct proportion, there would be required 121 lb. coal to give an average rise of 9·6° F. for 81·6 hours, so that 121 lb. coal can be taken as equal to 112·5 units, or one unit equals 1·075 lb. coal, and assuming coal at 20s. per ton, electricity to compete must sell at ·115d. per unit. The efficiency of coal heating is often stated as being as low as 10 per cent., but these figures would point to a considerably higher value.

Taking the case of the first room, 115 × 3,428 = 394,220 B.TH.U. = heating value of electricity used, and it has been shown that 128 lb. coal has the same effective heating value, so that 394,220 ÷ 128 = 3,097 = effective B.TH.U. per lb. of coal. There were actually about 15,000 B.TH.U. per lb. of this coal, so that the efficiency is about 20·5 per cent.

The amount of ventilation will obviously affect the number of units taken to heat up a room, and in all the experiments in the private office one window was open six inches at the top. The area of the windows was 54 sq. ft., and of the walls 745 sq. ft., and if the formula for the KW. required to heat a room—

$$\text{KW.} = \frac{(30\,A + 8\,B + n\,C)\,20{\cdot}4 \times t}{3{,}600 \times 1{,}000}$$ be applied,

where A = sq. ft. of window surface,
B = ,, wall surface,
C = cubic contents of room,
$t$ = temperature rise,
$n$ = number of times air changed per hour,

then it would appear that the number of times the air was changed per hour averaged ten.

The writer is aware that this is considerably in excess of the number of changes of air per hour necessary for health, but the difficulty of regulating this is great and will depend also on the number of people in the room, and it is better to err on the side of changing the air too frequently than not to change it often enough.

Even supposing that the air was only changed three times per hour, the energy consumed would be 1·206 units per hour, against a coal cost of ·34d. per hour, so that to reduce the electrical cost to the same price, energy would have to be sold at ·282d. per unit, and this is assuming that the coal cost remained the same with three changes of air per hour as it was with ten changes, and of course it would really be lower.

The writer considered that it would be of interest to obtain figures from heating by gas fires, and observations were taken for a week in an office heated by the latest and most efficient type of gas fire.

The area of the windows was 107 sq. ft., of the walls 1,613 sq. ft., and the cubic contents of the room 8,325 cb. ft.

Readings were taken in the same way for a week of 47 hours. The average temperature rise was 11·7° F., with a consumption of 2,240 cb. ft. of gas. It was merely

a coincidence that the temperature rise was exactly the same as in the case of the electrically-heated office.

The following is a tabulation of the readings obtained :—

| Date. | Average outside temperature. | Average inside temperature. | Average rise of temperature. | Cubic feet of gas. | Cost at 2s. per 1,000. |
|---|---|---|---|---|---|
| Feb. 12 ... | 48·1 | 57·44 | 9·34 | 440 | 10 56d. |
| „ 13 ... | 44·97 | 57·12 | 12·15 | 350 | 8·4d. |
| „ 14 ... | 43·8 | 55·27 | 11·47 | 410 | 9·84d. |
| „ 15 ... | 43·3 | 54·9 | 11·6 | 220 | 5·28d. (Sat.) |
| „ 17 ... | 40·54 | 53·3 | 12·76 | 480 | 11·52d. |
| „ 18 ... | 40·18 | 53·1 | 12·92 | 340 | 8·16d. |
| 47 hrs. ... | 43·48 | 55·18 | 11·7 | 2,240 | 53·76d. |

The total gas consumed for one complete heating season, from October 5th, 1912, to April 29th, 1913, was 66,500 cb. ft., which at 2s. per 1,000 = £6 13s.

In the previous year the coal cost was £4 4s. 2d., but this included the period of the coal strike, and the fair comparison is with the year before that, when 4 tons 18 cwts. cost £3 13s. 7½d., so that comparing gas at 2s. with coal at 20s., gas costs 1·37 times the price of coal, and the relative cost of heating by the three systems would be :—

Coal, at 20s. per ton, equal to 1.
Gas, at 2s. per 1,000 cb. ft., equal to 1·37.
Electricity, at 1d. per unit, equal to 8·4.

These figures demonstrate the hopelessness of attempting to oust the domestic fire by electricity, even at the low rate of ½d. per unit, but for occasional uses and in special cases it is excellent, and would be far more used if radiators were let out on hire at reasonable rates. One particularly suitable place is an hotel bedroom, where it is usual to charge 1s. for a fire. If a radiator were fixed with a shilling slot meter, it would pay both the hotel proprietor and the guests who wish for a fire for a short time.

*Rental.*—There are so many different patterns of heaters that a definite price cannot be fixed for all, but as a general principle it may be taken that the life of radiators built up of sheet iron can be taken at 10 years, those built up of sheet copper at 12 years, and those built up of cast metal at 15 years. The renewals will vary according to the type of heating element, and must be allowed for in each separate class : in the lamp radiators, to be safe, a renewal of half the lamps per annum, and in the convector and Bastian heaters the renewal of all the elements in four years.

Taking the sinking fund as improved at 3 per cent., and the interest at 3·5 per cent., these charges will be :—

For 10 years' life, 12·223 per cent. of the first cost ;
„ 12 „ 10·546 „ „ „
„ 15 „ 8·876 „ „ „

The following list then gives the cost, rental and upkeep of the different types of radiators, based on these principles. It should be remembered, however, that the prices given for the radiators are simply the ordinary trade terms for a single radiator, and that very much better terms would be obtained if a contract for a large number were entered into, so that the cost, rental and upkeep would therefore be *lower* in actual practice than the figures given.

| Type. | First cost. | Estimated life. | Rate % for sinking fund. | Interest and sinking fund. | Renewa's. | Rent per ann. |
|---|---|---|---|---|---|---|
| Cheap 2-lamp radiator ... | 20/– | 10 yrs. | 8·723 | 29·3d. | 30d. | 5/– |
| 4-lamp ditto. ... ... | 25/– | 10 „ | 8 723 | 36·7d. | 60d. | 8/– |
| Betterclass 2-lampradiator | 65/– | 10 „ | 8·723 | 103d. | 30d. | 11/– |
| 4-lamp ditto. ... ... | 77/– | 10 „ | 8·723 | 113d. | 60d. | 14/6 |
| F-type Bastian heater ... | 48/– | 15 „ | 5·376 | 51·12d. | 46d. | 8/– |
| C.I. convector, 1,000 watts | 55/– | 15 „ | 5·376 | 58d. | 33d. | 8/– |
| 1,500 watts ditto.... ... | 62/6 | 15 „ | 5 376 | 66d. | 49·5d. | 10/– |
| Sheet copper. 1,500 watts | 76/6 | 12 „ | 7·046 | 97·5d. | 49 5d. | 12/6 |
| „ „ 2,000 watts | 92/– | 12 „ | 7·046 | 116·5d. | 66d. | 16/– |
| „ „ 2,500 watts | 103/6 | 12 „ | 7·046 | 131d. | 82·5d. | 18/– |

The procedure would be much the same as in the case of the motors on hire. There would be a difference in the application form and in the valuation book, to suit the different apparatus. There would be no necessity to send an inspector round to examine, unless the hirer sent to say that something was wrong.

*Wiring.*—The wiring in connection with the radiators should not be done free nor included in the rental for the apparatus, and if done at all should be paid for out of revenue and charged up to the hirer.

Building contractors when putting up new properties should be urged to install plugs in the different rooms, so that a radiator can be put in at any time.

Wiring contractors also should be circularised as to the necessity of putting in wires of sufficient size to take electric heating and cooking apparatus which is certain to come later on. The present tendency, especially in tenements, is to cut down the copper to the lowest in order to give a cheap price, but this policy will prevent the adoption of electric heating and cooking, because people will not go to the bother and expense of putting in special wires, particularly where the house is not their own.

## AIR FILTER PLANTS FOR ELECTRIC GENERATORS.

The subject of air filtration in connection with the cooling of electric generators has been prominent of late ; the following description of modern type of air filter plant which has been developed by Messrs. Balcke and Co., Ltd., of Westminster, S.W., may therefore be of interest. Its construction is shown diagrammatically in figs. 1-3. It consists of a wooden frame, stretching apparatus, pocket frames and pockets. The wooden framework is made of the very best selected pitch-pine, of very strong section, free from all defects, and securely connected by mortised and tenoned joints, cleats and bolts. The whole of the woodwork, both of the framework and the other parts of the filter, is treated with linseed oil. If specially called for it can be impregnated under pressure with fireproof composition, after, in the first instance, the sap in the wood has been removed by vacuum. The filter is thereby rendered absolutely fireproof, right through every fibre of the wood.

The stretching apparatus for each section of the filter consists of two horizontal bars, each of which is tightened by two screws (10), between which and the bars is interposed a spring (12), so that any slackening or tightening of the cloth due to atmospheric influences can be automatically taken up. The pocket frames are hooked into an elastic steel wire rope (8), so that any inequalities in the depth of the pockets are automatically adjusted. The main timbers of the pocket frames (2) are made of best selected pitch-pine ; the thin sections of best fir. They carry at one end the tightening frame (1), and for the easy removal of the pockets a handle (3). The pockets are made of best cotton cloth, and can be impregnated with fireproof solution. They are bound at the pure-air opening with a strong linen tape, with elastic cord for fixing the pocket to the tightening frame (1). It will be seen from the drawings that the cord forming the end of the pocket is pressed into a groove on the outer rim of the tightening frame, and rests against the partition frame (4), between each two individual pockets, while, at the same time, the pocket frame can move independently of the tightening frame, so that immediately a pocket is placed into position and fixed to the elastic wire, an air-tight joint is made between the tightening frame and the partition frame (4), the friction at the joint relieving any tension on the cord of the pocket edging, and making it thereby impossible for this to be drawn out of its position in the groove.

The erection of the filter is exceedingly simple, and after the fitting-up of the frame and stretching apparatus, the pockets with their respective pocket frames are simply inserted in the opening, hooked into the wire ropes and stretched evenly by tightening the four bolts (10). The replacing of the pockets is equally simple, and after slackening the four bolts referred to, they can be immediately unhooked from the frame and withdrawn from the pure-air space. It is also possible, after having withdrawn two or three pockets from the pure air space, to remove the remaining pockets with their respective frames from the impure-air space.

A wet air filter has also been designed by Messrs. Balcke to meet the demand for a type of plant which does not use cloth as the filtering medium (see fig. 4). The filter casing is of galvanised sheet steel, the lower portion forming a water tank and the upper portion the filter proper, each being pro-

vided with facings for the water inlet and outlet connections. The air inlet is closed with wire netted doors, which could, if required, be replaced by louvred doors. Immediately behind the same a system of sprayers is arranged, which breaks up

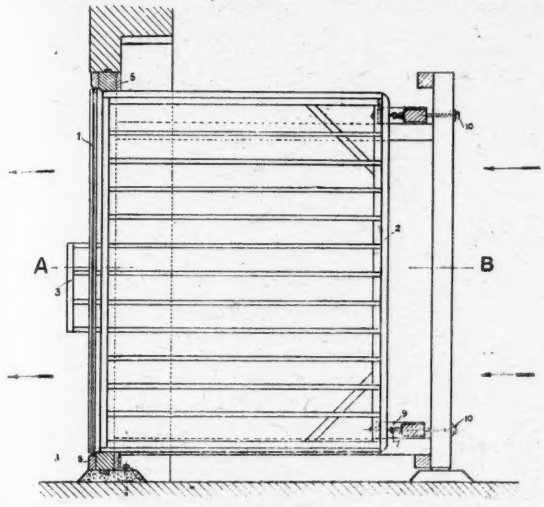


Fig. 1.—Balcke Air-Filter. Section on B C, Fig. 2.

the water into a fine spray, thoroughly atomising it. The air is thereby brought into intimate contact with the water, so that the impurities are thoroughly moistened, and either fall by gravity into the tank, or are separated from the air by the baffle plates. The atomised spray is thrown in the

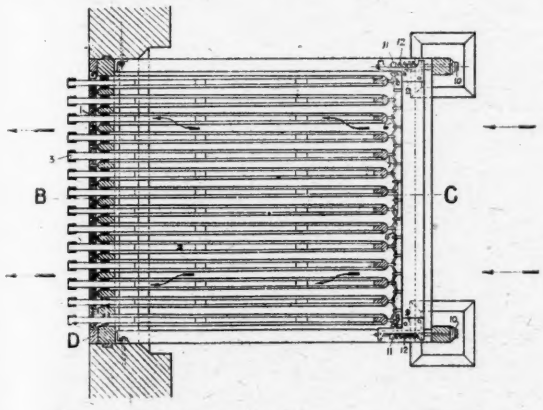


Fig 2.—Section of Air-Filter, on A B, Fig. 1.

direction of the air flow, so that instead of offering resistance to the air as in the case of filters where the direction of the spray is opposed to the air flow, it will assist the flow of the air, thereby reducing the labour thrown on the fan and generator.

The nozzles are made of gun metal, and are of such construction that they cannot easily choke ; the piping of the sprayers is all galvanised. As the spraying system is only a

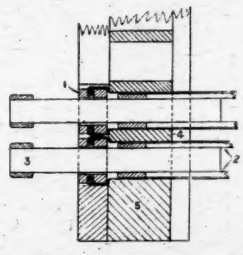

Fig. 3.—Detail at Corner D, Fig. 2.

few inches away from the air inlet, it can be attended to without entering the filter, by opening the doors while the filter is in operation. The same water is used over and over again, being circulated by means of a belt or motor-driven centrifugal pump, which will generally be placed in close proximity to the filter. The pump is designed to deliver the water to the nozzles at the correct pressure to obtain the most efficient spraying.

To dry the air thoroughly and retain any impurities carried by the spray, a system of baffle plates is arranged at the air outlet of the filter. These consist of galvanised sheet metal strips, arranged at an angle to the longitudinal centre line of the filter, alternate rows being inclined in opposite directions. Each baffle is provided with an upright channel at the outlet edge, into which the particles of moisture and impurities are thrown and drain to the bottom of the filter, preventing any deposit being carried through from one row of baffles to the next. Although the baffles are placed at close intervals, they offer practically no resistance to the air. At the upper end of the spraying system, a few special nozzles are arranged to throw water on to the top of the

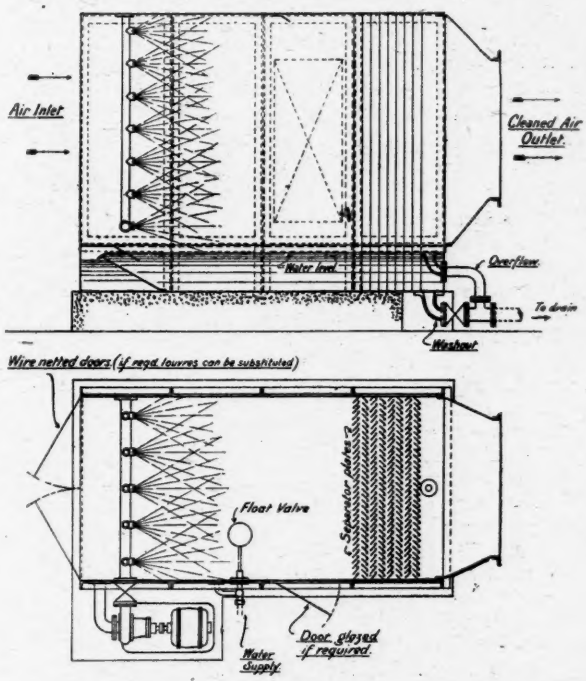


Fig. 4.—Elevation and Plan of Wet Air-Filter.

first row of baffles to assist in washing down any impurities retained. The air outlet end of the filter is provided with a conical cover, to which the air duct is connected. In the side of the casing an inspection door is provided, which can be glazed if required.

The tank at the air outlet end of the filter is provided with a large wash-out connection and overflow, with suitable valves leading into one common drain pipe, as at this end most of the impurities will settle. The pump suction is arranged at the opposite (the air inlet) end, separated from the main tank by a sloping partition protected with a removable cover. The flow of water towards this suction is exceedingly slow, so that all the impurities, with the exception of the most minute, will settle in the bottom of the tank without getting to the suction chamber. The tank is provided with a make-up water ball cock and separate connection for quickly filling the tank after the same has been washed out, from the same source. A further connection is made from this make-up water pipe to the inlet end of the filter, to which a short piece of hose pipe can be connected to wash out the tank when it is being periodically cleaned.

**Commercial Development in Canada.**—We have received from a Canadian correspondent a copy of the "Electric Service Magazine," which is issued monthly by the Toronto Electric Light Co., and is distributed gratis to all their consumers. The magazine gives illustrations relating to the company's plant, brief articles and notes forcibly driving home the advantages of electricity in every walk of life, examples of handsome fittings in the Bank of Toronto, &c. It is a bright little paper, and likely to interest the layman in the possibilities of electricity supply.

## WATER STERILISATION BY ULTRA-VIOLET RAYS.

In a paper recently read before the Société International des Electriciens, M. de Recklinghausen gives some interesting particulars of an improved mercury vapour lamp arrangement for use in sterilising large quantities of water, such as the whole water supply to a town.

The first experiments were carried out with quartz mercury vapour lamps of the Westinghouse Cooper Hewitt Co.'s make. The lamp was inserted in a separate chamber provided with rock crystal windows (fig. 1), so as to avoid

Fig. 1.—Section of Sterilising Chamber.

actual contact between the lamp vessel and the water. In this way the comparatively high lamp temperature essential for the economical production of the ultra-violet rays was maintained. The water to be treated is subjected to a preliminary partial filtration to remove matter in suspension and render it as transparent as possible, and it then passes in front of the lamp chamber and is subjected to the action of the rays.

Experiments with apparatus of this form extending over two years proved that at an expenditure of 25 to 30 watt-hours per cubic metre of water practical sterilisation was attained. Bacteriological examination showed that the number of germs had been reduced to 10 per cubic centimetre (after 15 days' culture) and in many cases even to zero. The colon bacilli, which are sometimes found in unpurified water, were entirely absent after the sterilisation. When the water was at all discoloured, it was found necessary to reduce the rate of flow past the lamp to obtain equally good bacteriological results.

On the whole, these early experiments were satisfactory, but showed that a large number of such lamps would be

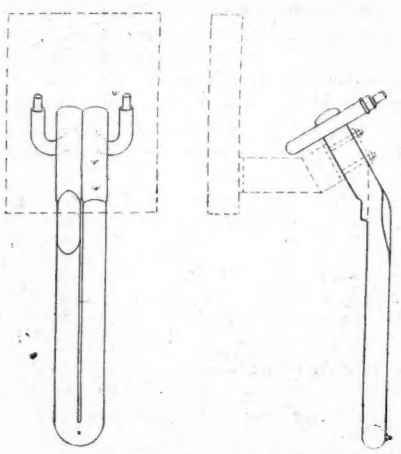

Fig. 2.—Improved Form of Lamp.

necessary to deal with any public water supply. Consequently the construction of a more powerful form of apparatus was decided upon.

With the original shape of lamp and protecting chamber only some 60 per cent. of the light actually reaches the water, and in order to reduce this loss the form of lamp was changed to that shown in fig. 2. It consists of a U-tube of quartz with the two branches quite close together, the length of each branch being 6½ in. in the lamp suitable for a 500-volt 3-ampere supply. In this way the two electrodes are brought together at one end and are cooled by a single radiator, whilst the luminous portion of the lamp is free to be inserted into an external quartz tube of comparatively small diameter projecting into the water chamber.

Such a lamp, though connected to a 500-volt circuit, has about 375 volts across the actual electrodes and gives some 8,000 c.p. measured at right angles to the length of the lamp.

Comparing this lamp with the older 110-volt lamp as regards its effect on the colon bacillus (the typical bacillus in polluted water) it was found that the same degree of sterilisation could be obtained with it about 60 times as quickly. Compared with the 110-volt 8-ampere lamp, the effect was about 50 times as great and compared with the 220-volt 3½-ampere lamp about 11 times as great.

The arrangement of the lamp in the water-flow chamber is shown in fig. 3. When two lamps are required, a single straight quartz tube running right across the chamber is used with a lamp inserted at each end of it.

The lamps are ignited by tipping them as usual, but, in order to avoid the use of an unnecessarily wide outer quartz tube, this tipping is done after withdrawing the lamp (on its stand) towards the back. When alight the lamp is

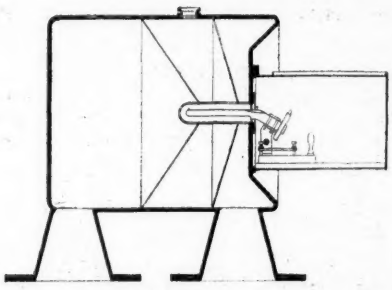

Fig. 3.—Section of Improved Apparatus.

returned into its working position in the chamber. The operator is protected from the effects of the ultra-violet rays by a cover containing an inspection window. Baffle plates are provided, as shown, in the water chamber to ensure a thorough stirring of the water whilst under the action of the rays.

An electromagnetic relay, operated by the lamp current, is arranged to cut off the flow of water should the lamp become extinguished at any time accidentally. Also, when several lamps are used in parallel, the circuit is so arranged that if one lamp becomes extinguished accidentally, the rest are immediately cut off automatically.

Such a plant as the above, provided with two 500-volt, three-ampere lamps, was tested with from 1,600 to 2,000 cubic metres (350,000 to 440,000 gallons) a day of ordinary river water which had been roughly filtered, but which still retained a marked yellowish tinge. The resulting water contained from 0 to 9 germs at most per cubic centimetre (average 2·5 germs), whilst originally there were between 56 and 655 germs per cubic centimetre.

An important question in connection with such plants is the length of life that may be expected. The new U-shaped lamps have been only recently introduced, but the experience gained with the first installations has shown that no appreciable falling-off in ultra-violet rays occurs at least up to 1,300 hours of work, and there seems to be no reason why their life should not extend to 3,000 hours or more, as with the ordinary quartz lamps. In the laboratory at the Sorbonne some lamps tested after 7,000 hours' use have shown only from 10 per cent. to 15 per cent. reduction in ultra-violet rays.

**Insulated Wires in Germany.**—The manufacturers of insulated wires in Germany, exclusive of telephone and telegraph wires, formed a price association a year ago. It is now intended to establish a sales bureau in the form of a company, which, whilst allowing a suitable profit to the trade, will undertake sales on common account for Germany. The level of prices, it is stated, has not undergone any change.

## TRADE STATISTICS OF SWEDEN.

The following figures show the imports of electrical and similar goods into Sweden during the year 1911, and are taken from the official statistics which have recently been issued; the figures for 1910 are given for purposes of comparison, and notes of any increases or decreases have been added. The predominance of German trade in nearly all branches will be noticeable.

| | 1910. Kronor. | 1911. Kronor. | Inc. or dec. Kronor. |
|---|---|---|---|
| *Electric Meters.—* | | | |
| From Germany ... ... | 611,000 | 692,000 | + 81,000 |
| „ Great Britain ... | 71,000 | 68,000 | — 3,000 |
| „ Other countries ... | 2,000 | 7,000 | + 5,000 |
| Total ... | 684,000 | 767,000 | + 83,000 |
| *Electric Incandescent Lamps.—* | | | |
| From Germany ... ... | 642,000 | 929,000 | + 287,000 |
| „ Great Britain ... | 1,000 | — | — 1,000 |
| „ Switzerland ... | 7,000 | — | — 7,000 |
| „ Austria-Hungary ... | 29,000 | 20,000 | — 9,000 |
| „ Holland ... ... | 7,000 | 91,000 | + 84,000 |
| „ Other countries ... | 9,000 | 16,000 | + 7,000 |
| Total ... | 695,000 | 1,056,000 | + 361,000 |
| *Dynamos and parts thereof.—* | | | |
| From Germany ... ... | 184,000 | 162,000 | — 22,000 |
| „ Great Britain ... | 4,000 | — | — 4,000 |
| „ Switzerland ... | 81,000 | 23,000 | — 58,000 |
| „ France ... ... | 12,000 | — | — 12,000 |
| „ Other countries ... | 7,000 | 16,000 | + 9,000 |
| Total ... | 288,000 | 201,000 | — 87,000 |
| *Electric motors and parts thereof.—* | | | |
| From Germany ... ... | 447,000 | 468,000 | + 21,000 |
| „ Great Britain ... | 7,000 | 12,000 | + 5,000 |
| „ Switzerland ... | 12,000 | — | — 12,000 |
| „ France ... ... | — | 11,000 | + 11,000 |
| „ United States ... | 22,000 | 19,000 | — 3,000 |
| „ Other countries ... | 28,000 | 34,000 | + 6,000 |
| Total ... | 516,000 | 544,000 | + 28,000 |
| *Transformers and parts thereof.—* | | | |
| From Germany ... ... | 235,000 | 242,000 | + 7,000 |
| „ Great Britain ... | 2,000 | — | — 2,000 |
| „ Switzerland ... | 22,000 | 16,000 | — 6,000 |
| „ Other countries ... | 1,000 | 6,000 | + 5,000 |
| Total ... | 260,000 | 264,000 | + 4,000 |
| *Telephone apparatus.—* | | | |
| From Germany ... ... | 6,000 | | — |
| „ Great Britain ... | 1,000 | No details. | — |
| „ Other countries ... | 2,000 | | — |
| Total ... | 9,000 | 7,000 | — 2,000 |
| *Telegraph apparatus.—* | | | |
| From Denmark ... ... | 3,000 | | — |
| „ Germany ... ... | 2,000 | No details. | — |
| „ Great Britain ... | 2,000 | | — |
| Total ... | 7,000 | 11,000 | + 4,000 |
| *Turbines.—* | | | |
| From Norway ... ... | 17,000 | — | — 17,000 |
| „ Germany ... ... | 1,000 | 33,000 | + 32,000 |
| „ Great Britain ... | 3,000 | 7,000 | + 4,000 |
| Total ... | 21,000 | 40,000 | + 19,000 |
| *Accumulators.—* | | | |
| From Germany ... ... | 497,000 | 796,000 | + 299,000 |
| „ Great Britain ... | 6,000 | 27,000 | + 21,000 |
| „ Other countries ... | 1,000 | 2,000 | + 1,000 |
| Total ... | 504,000 | 825,000 | + 321,000 |
| *Rheostats.—* | | | |
| From Germany ... ... | 689,000 | 799,000 | + 110,000 |
| „ Great Britain ... | 19,000 | — | — 19,000 |
| „ Switzerland ... | 69,000 | 24,000 | — 45,000 |
| „ Denmark ... ... | — | 40,000 | + 40,000 |
| „ Other countries ... | 16,000 | 18,000 | + 2,000 |
| Total ... | 793,000 | 881,000 | + 88,000 |
| *Elevators.—* | | | |
| From Germany ... ... | 44,000 | 19,000 | — 25,000 |
| „ Great Britain ... | 5,000 | — | — 5,000 |
| „ Other countries ... | 2,000 | 18,000 | + 16,000 |
| Total ... | 51,000 | 37,000 | — 14,000 |
| *Cranes.—* | | | |
| From Germany ... ... | 38,000 | 255,000 | + 217,000 |
| „ Great Britain ... | 85,000 | 109,000 | + 24,000 |
| „ United States ... | 91,000 | — | — 91,000 |
| „ Other countries ... | 25,000 | 93,000 | + 68,000 |
| Total ... | 239,000 | 457,000 | + 218,000 |
| *Copper wire, twisted, and cable not insulated.—* | | | |
| From Germany ... ... | 137,000 | 79,000 | — 58,000 |
| „ Other countries ... | — | 5,000 | + 5,000 |
| Total ... | 137,000 | 84,000 | — 53,000 |
| *Copper wire covered with textiles.—* | | | |
| From Germany ... ... | 7,000 | 11,000 | + 4,000 |
| „ Other countries ... | 1,000 | 2,000 | + 1,000 |
| Total ... | 8,000 | 13,000 | + 5,000 |
| *Copper wire covered with rubber.—* | | | |
| From Germany ... ... | 2,000 | No details. | — |
| „ Other countries ... | 1,000 | | — |
| Total ... | 3,000 | 3,000 | — |
| *Electric cables covered with lead.—* | | | |
| From Germany ... ... | 3,078,000 | 5,215,000 | +2,137,000 |
| „ Holland ... ... | 63,000 | 49,000 | — 14,000 |
| „ Great Britain ... | 281,000 | 267,000 | — 14,000 |
| „ Other countries ... | 2,000 | 5,000 | + 3,000 |
| Total ... | 3,424,000 | 5,536,000 | +2,112,000 |
| *Copper wire otherwise insulated.—* | | | |
| From Germany ... ... | 279,000 | 320,000 | + 41,000 |
| „ Great Britain ... | 21,000 | 21,000 | — |
| „ Other countries ... | 9,000 | 1,000 | — 8,000 |
| Total ... | 309,000 | 342,000 | + 33,000 |
| *Other electric cable.—* | | | |
| From Germany ... ... | 326,000 | 404,000 | + 78,000 |
| „ Great Britain ... | 10,000 | 29,000 | + 19,000 |
| „ Other countries ... | 1,000 | 1,000 | — |
| Total ... | 337,000 | 434,000 | + 97,000 |
| *Steam turbines.—* | | | |
| From Germany ... ... | 114,000 | 154,000 | + 40,000 |
| „ Great Britain ... | 18,000 | — | — 18,000 |
| „ Switzerland ... | 29,000 | — | — 29,000 |
| „ Other countries ... | — | 9,000 | + 9,000 |
| Total ... | 161,000 | 163,000 | + 2,000 |
| *Steam boilers.—* | | | |
| From Germany ... ... | 36,000 | 68,000 | + 32,000 |
| „ Great Britain ... | 230,000 | 26,000 | — 204,000 |
| „ Other countries ... | 7,000 | 16,000 | + 9,000 |
| Total ... | 273,000 | 110,000 | — 163,000 |

Krone = 1s. 1⅛d.

**The Anglo-American Exposition, 1914.**—A great demonstration of what the progress of the world owes to Anglo-Saxon invention and industry will take place at the White City next year, in the shape of an Anglo-American Exhibition. The inception of the scheme is due to the American Society in London, and the actual work was inaugurated at a meeting at the Mansion House. The support which the Exposition has received since the meeting, exceeds even that for the Franco-British Exhibition of 1908. The Duke of Connaught has consented to be patron, and the Duke of Teck, president of the Exposition, whilst Lord Curzon, the Earl of Derby, Lord Rothschild, Lord Strathcona, Lord Weardale, the Lord Mayor of London, Sir Archibald Geikie, the Right Hon. Sir William Mather, and Sir Edward Poynter, have accepted positions as vice-presidents of the Exposition.

The Executive Committee includes the Earl of Kintore, chairman; Lord Blyth, chairman of the Organising Committee; the Hon. Sir John A. Cockburn, Lord Rotherham, the Hon. Arthur Stanley, and most of the vice-presidents.

The United States Government has promised its cordial co-operation and support, and two of the principal buildings and one-half of the Fine Arts Palace have been set aside for the U.S. Government exhibits.

A strong American Committee has been formed, as well as an American Executive Committee, and a Local Executive Committee in each of the important cities, all of which are working with enthusiasm to make the Anglo-American Exposition surpass all previous exhibitions held in London. The profits will be devoted to objects of national utility and importance in the United Kingdom and the United States.

## A REMOTE-READING HYGROMETER.

[BY OUR BERLIN CORRESPONDENT.]

A determination of the moisture of air is of the highest importance in the storage rooms of slaughter-houses, in granaries and storehouses, in the malt-floors of breweries and malt factories, in the workshops of spinning mills and in hothouses, in fact, wherever goods are produced or kept, the quality of which is influenced

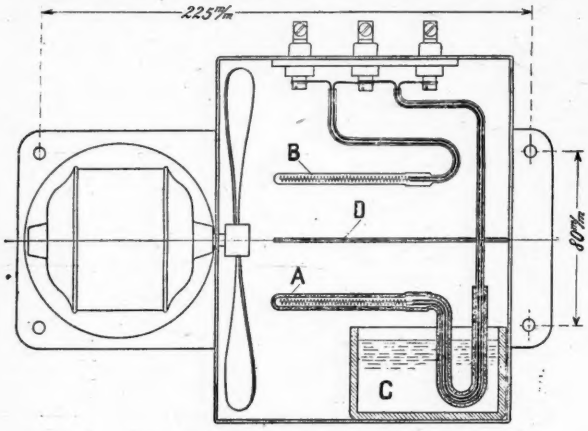


Fig. 1.—Details of Hygrometer.

by the variable degree of atmospheric moisture. It is especially desirable to be able to transmit moisture readings to remote points of a given building or set of buildings. Where there are ozone or ventilation plants in operation—in schools, banking houses, offices or dwelling rooms—the provision of moisture remote-gauges is likewise a most desirable feature.

A reliable remote-reading hygrometer has recently been designed on a system suggested by Mr. Constanz Schmitz, by Messrs. Siemens Bros. This is based mainly on the aspiration psychrometer principle, the only scientific method of moisture determination. The mercury thermometer of the ordinary apparatus is replaced by quartz glass resistance thermometers, which have been for some years used with satisfactory results for remote readings of temperature, their small dimensions, reliable insulation, even when damp, &c., being especially valuable in this connection.

Two such quartz glass resistance thermometers are arranged in a tube-shaped casing at the place where the moisture in the air is to be checked (fig. 1). Thermometer A is coated with a porous sleeve, drawing up distilled water from a vessel C. The other resistance

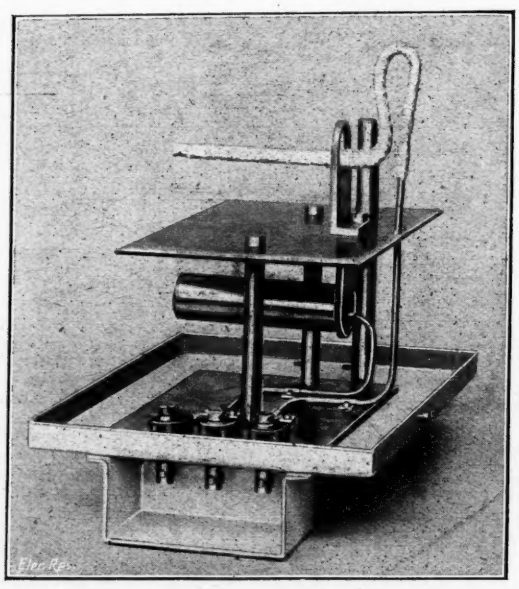

Fig. 2.—Complete Hygrometer (Inverted).

thermometer B is separated from the former by a diaphragm D, and is what is called the "dry" thermometer. As the air, the moisture of which is to be determined, passes through the casing enclosing the two thermometers, evaporation on the "moist" thermometer will produce a difference of temperature between this and the "dry" thermometer. The relation between moisture on the one hand, and temperature and temperature difference on the other, has been accurately ascertained and is embodied in Jelinek's psychrometer tables. As, however, the figures given in these tables are only true in the case of air velocities of 1 m. as a minimum, a ventilating fan should be provided in the case of slower air motion, to drive the air past the thermometers at the proper velocity. Psychrometer readings leaving this factor out of account are liable to show considerable errors. Provision has been made in this remote hygrometer for the fan motor to be thrown on and off simultaneously with the thermometers by a single manipulation, eliminating any risk of mistake, so as to avoid any waste of current.

For temperature remote-readings there are used Messrs. Siemens Bros.' temperature remote-gauges (fig. 3) fitted with a milli-voltmeter of precision and a key switch with automatic key stopping and disengaging device, a pressure key being provided for each set of "dry" and "moist" thermometers. Temperatures are read directly from the temperature scale, after inserting the thermometers, by pressing down the key (possibly starting at the same time the fan motor). In reading the "moist" thermometer temperature the operator should wait a few minutes until the index has adjusted itself to the lowest point of the scale corresponding to the actual circulation of air. The psychrometric difference of temperature having been ascertained from the two readings, the corresponding degree of moisture is derived from the table supplied with each apparatus. Measurements are further simplified in case the temperature of the "dry" thermometer only fluctuates between narrow limits. In this case, the temperature of the second thermometer being left out of account, the second determination simply

Fig. 3.—Remote Indicating Apparatus.

consists of reading the temperature difference, directly and without any calculation, from the second milli-voltmeter scale, which is graduated in degrees of temperature, or possibly in degrees of moisture for a given temperature. In this case the normal temperatures and temperature limits should be accurately given.

Three lines are required for each pair of thermometers, to connect the remote gauge with the resistance thermometers. A 4-volt accumulator is preferably used as the source of measuring current—the fan motor being connected up to the lighting mains by means of two further lines, across the remote-gauge switch. Recording remote hygrometers are designed on the same system.

The "dry" thermometer of the remote-reading hygrometer does away with the need of any special thermometer for determining the room temperature.

## ELECTRICITY IN AGRICULTURE.

The following communication has been received by the Westinghouse Cooper Hewitt Co., Ltd., from Miss E. C. Dudgeon, of Lincluden House, Dumfries, regarding her experimental work on the acceleration of plant growth under mercury vapour lamps:—

Seeds germinated several days, and in some cases weeks, before those sown and grown under precisely similar conditions in a control house, as the following table will show:—

| | *Experimental house.* | *Control house* |
|---|---|---|
| French beans ... ... ... | 13 days | 21 days |
| Carrots ... ... ... .. | 11 „ | 26 „ |
| Cauliflower ... ... ... | 6 „ | 26 „ |
| Maize ... ... ... ... | 8 „ | 57 „ |
| Lettuce ... ... ... ... | 6 „ | 12 „ |
| Maple peas ... ... ... | 6 „ | 16 „ |
| Vegetable peas (filbasket) ... | 7 „ | 16 „ |
| Oats ... ... ... ... | 7 „ | 12 „ |
| Barley ... ... ... ... | 7 „ | 12 „ |
| Wheat ... ... ... ... | 8 „ | 16 „ |

Several other seeds, foreign ones, such as China and Syrian beans, Soya beans, were experimented with for germination with similar results.

The quality of seedlings was remarkably good they being sturdy of stem and strong in leaf.

The temperature of the greenhouse was kept low, the following being the averages for three months :—

| | *Experimental house.* | *Control house.* |
|---|---|---|
| January ... | Day 58° night 46° | Day 59° night 48° |
| February ... | Day 60° night 46° | Day 67° night 50° |
| March ... | Day 73° night 47° | Day 78° night 50° |

The control house is situated in a position where it gets slightly more sun than the experimental house, and this caused the rather higher temperature on the average.

The earth temperature was taken at intervals, during the time the lamp was on, *after sunset* in both houses, and showed no perceptible difference.

All plants responded satisfactorily to the light treatment ; besides seeds, geraniums, roses, carnations and heliotrope were placed in the house and showed a marked increase in foliage and flowers of good size, colour and shape. The rose tree "Belle Lyonnaise," which had flowered all the previous summer and autumn, was pruned in November as bare as a vine. In two weeks it showed leaf, in six weeks buds, and it has continued to bloom ever since.

Strawberries flowered abundantly, and the fruit ripened very well. It was proved that there was an increase in the crop of 25 per cent.

The plants are placed on a staging about 4 ft. from the lamps ; the radiation extended over the whole house (20 ft. long) which was tested by photographic printing paper exposed after sunset. The best results were those obtained within 8 ft. radius of the lamp ; as the radiation became less the growth was less, as could very soon be seen by a casual glance over the staging.

The lamp was put on about an hour *before* sunset, and kept on for about 4½ hours.

The general inference from the experiment is that if carried out on a large scale it would be a source of great profit to the market gardener. A considerable amount of *heating* is saved ; the seedlings require practically no hardening-off before being planted in the open. I put out about a dozen cauliflowers in March, protected the first night by a glass shade ; the next two nights a mat was thrown over them, and after that nothing. They were exposed to frost, but their growth is in no way retarded, and they look remarkably strong plants.

Beans and peas are now ready for use, those in the control house being much later ; pods in the control house formed but quite two weeks behind experimental. I failed altogether with lettuces in the control house ; they apparently required more heat. Also French beans. Both did well in the experimental house ; in fact, the lettuces were very fine.

The expense of the lamp is not much ; a practical electrical engineer worked out for me that the consumption would be rather less than one-fifth of a KW.

Prof. Priestley, of the Bristol University, very kindly made the analysis of the plants for me, and the following is a quotation from a lecture delivered by him in London on April 3rd regarding my experiment :—

"The light seems to have been extraordinarily efficacious, producing accelerated germination, increased growth, greater depth of colour, and, more important still, no signs of the lanky, unnatural extension of plant usually associated with forcing. Rather, the plants exposed to the radiation seem to have grown, if anything, more sturdy than the control plants. . . . . A structural examination of the experimental and control plants carried out by means of a microscope fully confirms Miss Dudgeon's statements both as to the depth of colour and greater sturdiness of the treated plants."

## POINTS IN SHOP LIGHTING.

THE conditions which determine the success or failure of shop lighting involve a considerable number of interesting features which have to be carefully examined before complete satisfaction can be obtained. It may, therefore, be of interest to refer briefly to some leading ideas on the subject which were ably explained some little time ago by Mr. E. L. Elliott in the columns of our esteemed American contemporary, *Illuminating Engineer*.

The useful points brought out in that contribution may be briefly summarised as follows :—The intensity will vary with the class of goods, and dark-coloured merchandise, such as men's clothing, requires twice the amount of light necessary for white goods or light-coloured fabrics ; a margin of from two to five candles covers the difference. If an illumination of five ft.-candles is provided for dark goods, it will be better to reduce the density in the room devoted to lighter-coloured goods. Tapestries, wall-papers, and the like, are usually displayed in a vertical plane of a non-reflecting quality. Floor coverings, furniture, and such commodities are also usually dark in colour and non-reflecting ; excessive intensity is to be avoided, as the buyer afterwards seeing the goods in ordinary daylight, may believe that he has been deceived.

As regards the colour value of the light, a wide margin is possible, as such light sources as carbon-filament lamps, Nernst lamps, &c., give warm tones, while unshaded arcs and partly-enclosed arcs give a cold or hard tone ; neutral light may be obtained from metallic or luminous arcs, flame arc lamps with special carbons, and the new types of metallic-filament electric lamps. In no case is a cold or hard light preferable to a neutral or warm one, but in shops selling hardware, groceries, &c., cold lights may be acceptable. Some shops dealing in coloured fabrics of delicate shades and tints, must be very careful as to the light they adopt, as tints that would produce harmonious combination by daylight, may very readily give a discordant effect by ordinary artificial light. The colour of light sources may be modified between certain limits by reflection, and by transmission through transparent or translucent media. In some cases the loss necessary to produce neutral light is so great as to render the process impracticable. Light sources which have a preponderance of blue and violet, such as the arc lamp, may be slightly modified to give a neutral tone by using an opalescent glass of the right density and composition. The colour of light can be modified by reflection from a dense surface, but this is far less efficient than by transmission.

The situation of lamps will generally be a compromise between the structural conditions and considerations of light distribution. Thus, a large ceiling divided into panels involves the placing of units symmetrically with regard to the structure, as ceilings are usually very light in colour, and a surface will thus reflect 50 to 60 per cent. of the light falling on it ; this affords a strong inducement for placing the light units high up. Where show-cases or shelving with glass doors are used, care should be taken to place the lights high enough to avoid reflection in the glass.

Shop illumination is first and foremost utilitarian, but it is almost an absolute necessity to make the illumination as decorative as possible in order to make the shop attractive. There are many cases in which special lighting for special effects should be installed ; for example, in show-cases in the interior of a shop the same principle should be applied as to a shop window—the question of using concealed lights should be considered. The provision of Linolite or similar lamps in the interior of show-cases gives a very high-class effect. In some of the most modern American stores special rooms have been fitted up, equipped with both gas and electric lamps for the purpose of showing how coloured fabrics will appear both in gas light and electric light ; these are intended for use during the day as well as the evening, and are especially useful for displaying millinery and dress goods.

The first cost of the installation should not be the preponderating consideration, as, compared with the cost of the building itself, as well as with other fixtures of the shop, it bulks very small in the total bill, while cutting down lighting in a show window entails a perpetual loss in results. The only debatable question is that of the purely decorative features, and these should very properly be charged to the advertising account, and not to the lighting bill. The electric arc appears to afford the cheapest form of electric lighting, but, as pointed out above, the conditions of the shop may preclude the use of that lamp when compared with decorative glow-lamp lighting.

It should be remembered that the lighting installation must be kept in first-class order, both for the sake of reasonable economy and of satisfactory results. It is a sad fact that merchants who have their windows washed daily leave the glow-lamps untouched for a year at a time, whereas regular and systematic inspection of all accessible parts, and renewal of all defective portions, is an absolute necessity. It is hoped that these remarks may be of value to electrical engineers who are troubled with complaints as to their lighting by shop consumers who have not devoted sufficient attention to the details of their installations.

## FOREIGN AND COLONIAL TARIFFS ON ELECTRICAL GOODS.

### AMENDMENTS.

NEW ZEALAND.—The regulations as to the costs to be included in the estimation of 25 per cent. British labour for goods exported to New Zealand in order to gain the advantage of the British preferential tariff, have recently been revised. In estimating the amount of British labour involved in the preparation of goods, it is now permissible to include costs incurred in the packing of foreign-made goods, in, for instance, cartons or other containers. The certificate of origin for goods shipped to New Zealand, for which it is desired to secure the benefit of the preferential rates of duty, has been revised accordingly.

SOUTHERN NIGERIA.—Merchants have recently raised a point, in connection with the through booking of goods *viâ* Southern Nigeria to Northern Nigeria, relative to an alleged statement that railway freight to Kano from Southern Nigeria to Northern Nigeria is to be included in the value of goods for duty purposes. According to the *Nigerian Customs and Trade Journal*, the Customs authorities have stated that there is no such provision in the law, and that the value on which duty is assessed is the fair market value of the goods as sold in the country from which the goods are exported. In preparing invoices for Customs purposes, merchants are required to show separately cost of packing, freight, insurance, &c., but duty is not assessed on them.

CHILE.—The Chilean Government has decided that the surtax of 5 per cent. on all goods dutiable at the rates of 5 per cent., 15 per cent., 25 per cent., 35 per cent. or 60 per cent., which was recently imposed on goods for a period of three years from April 15th, 1912, is to be levied for a further 18 months after the expiration of that period.

COLOMBIA.—A Bill has been laid before the Colombian Parliament proposing certain alterations in the tariff; the following are the proposed new rates on certain electrical and similar goods:—

| | *Dollars per kg.* |
|---|---|
| Electrical apparatus:—Porcelain, wood, or glassware, with, or without, parts of metal ... ... | ·02 |
| Electrical accessories not separately specified ... | ·04 |
| Insulators of glass or porcelain ... ... ... | ·01 |
| Insulators of caoutchouc ... ... ... ... ... | ·03 |
| Measuring apparatus ... ... ... ... ... | ·02 |
| Apparatus not separately mentioned ... ... | ·04 |
| Telephone and telegraph apparatus ... ... ... | ·02 |
| Electroliers, &c.... ... ... ... ... ... | ·25 |
| Globes for incandescent lights ... ... ... | ·05 |
| Wire or cables protected with rubber, tar, &c. ... | ·01 |
| Dynamos, motors, transformers, rheostats ... ... | ·01 |
| Lamps for outside lighting ... ... ... ... | ·02 |
| Ventilators ... ... ... ... ... ... | ·10 |
| Wire of copper, &c. ... ... ... ... ... | ·20 |
| Bars of zinc ... ... ... ... ... ... | ·02 |
| Insulating materials ... ... ... ... ... | ·02 |
| Electro-medical apparatus and batteries ... ... | ·25 |
| Accumulators and plates ... ... ... ... | ·02 |
| Jars for batteries ... ... ... ... ... | ·02 |
| Tramway cars and wagons ... ... ... ... | free |
| Rails ... ... ... ... ... ... ... | free |
| Transmission gear ... ... ... ... ... | ·01 |
| Pumps and turbines ... ... ... ... ... | ·01 |
| Fuel oil ... ... ... ... ... ... ... | ·01 |
| Iron posts for electrical transmission work ... ... | ·01 |

WEST INDIES.—With reference to recent information relating to the certificate of origin requirements of the West Indies resulting from the inauguration of preferential treatment for British goods, it is now noted that certain West Indian Governments have decided to alter their regulations regarding signatures and attestation of signatures on certificates. New regulations provide that in the case of goods shipped direct from this country certificates of origin need only be verified by the signature of the exporter or his duly authorised representative. Certificates of origin for goods for which preferential treatment is desired, and which are not shipped direct, in order to be valid, must be attested to in British countries before a collector or other principal officer of Customs, notary public or other official authorised to administer oaths, and in other countries before a British Consul, and such attested certificates must bear the autograph signature of the authority issuing the same, together with the seal of office, if any. No certificate of origin shall be valid after the expiration of six months from the date of its issue.

As it is possible that goods may occasionally reach this Colony before the arrival of the certificates of origin relating to the same, the Customs authority may authorise the delivery of such goods at the preferential rates of duty on the security of a deposit equal in amount to the difference in duty between the preferential and general rates. Deposits will be forfeited at the end of 15 days after the expiration of the time allowed by the Customs authority for the production of the certificate of origin, which time may not be less than one month, nor more than six months, from the date of the importation of the goods. When goods accompanied by certificates of origin are not in uniformity with the descriptions borne on the certificates, by reason of discrepancies as regards the marks or numbers of the packages, or the kind, quantity or value of the goods, they are not to be entitled to preference unless the Customs authority at the port of destination is satisfied as to the origin of the goods, and that the differences are solely due to error. Goods certified for entry as goods entitled to preference will not be entitled to such preference unless they be packed separately from other goods. The packages, however, may be enclosed with other goods, provided the certificate of origin is endorsed accordingly. Goods will not be entitled to preference if they are set out in Customs bills of entry in which other goods are also set out.

The forms of certificates of origin for goods shipped direct, and for goods not shipped direct, have been made to vary slightly in accordance with the above regulations.

## NEW PATENTS APPLIED FOR, 1913.

**(NOT YET PUBLISHED.)**

**Compiled expressly for this journal by Messrs. W. P. Thompson & Co., Electrical Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford, to whom all inquiries should be addressed.**

20,216. "Unspillable electric accumulator cells." W. Thomson. September 8th.

20,230. "Electric lighting and starting of motor road vehicles and other motor-driven bodies." C. E. Simms. September 8th.

20,269. "Telegraphic systems employing the Morse code." W. S. Steljes. September 8th.

20,278. "Electric welding of metals having different melting points." G. Gruchtel. September 8th.

20,284. "Trolley poles." C. C. Wallace and C. A. Macey. September 8th. (Complete.)

20,288. "Pedal-driven electric generators for use in connection with projection apparatus." Soc. Internationale de Lumiere Froide (Procedes Dussaud). (Convention date, September 7th, 1912, France.) September 8th. (Complete.)

20,309. "Method of packing the joints of metal vapour alternating-current rectifiers and other vacuum apparatus." E. Hartmann. (Convention date, September 21st, 1912, Germany.) September 8th. (Complete.)

20,311. "Automatic transmitters for telegraph signals." Creed, Bille and Co., Ltd., and A. L. Pailthorpe. September 8th.

20,318. "Railway electric signals." E. O. Evans and J. B. Saunders and Co., Ltd. September 9th. (Complete.)

20,335. "Polarised cut-in and -out switch for battery charging." W. A. Stevens. September 9th.

20,346. "Devices for utilising short pieces of carbon in bioscope arc lamps." W. B. Robinson. September 9th.

20,361. "Sparking plugs." O. Freiberg and O. Petzsche. September 9th. (Complete.)

20,371. "Electric furnaces." C. A. Keller. September 9th. (Complete.)

20,438. "System of electric lighting." Van Raden & Co., Ltd., and M. Metz. September 10th.

20,482. "Devices for producing discharges in Röntgen ray tubes." Siemens Bros. & Co., Ltd. (Siemens & Halske Akt. Ges., Germany.) September 10th. (Complete.)

20,495. "Electric lighting for railway carriages." G. Inrig, A. Braid and G. J. Mills. September 10th.

20,500. "Vapour electric apparatus." E. E. Darmois and M. A. E. Leblanc. (Addition to 11,870/12.) September 10th.

20,521. "Rotary interrupters or contact-breakers and similar devices for use in connection with wireless telegraphy and like installations and for analogous purposes." A. B. Williams and W. A. Solomon. September 11th.

20,536. "Continuous-ringing electric bell for railway signal at danger." N. A. Rihot. September 11th.

20,534. "Suspenders for electric cables." P. Huntington. September 11th.

20,545. "Apparatus for automatically controlling the direction in which current can be supplied to electric circuits." W. H. Dammond. September 11th.

20,549. "Microphones." J. Hecht and N. Carlton. September 11th.

20,552. "Electric water heater of the geyser type." E. Welch. September 11th.

20,554. "Electric switches, terminals, and the like." F. Westwood. September 11th.

20,577. "Electric strip light reflectors." J. P. Child. September 11th.

20,588. "Electric generators and starters for internal-combustion engines, especially those of motor road vehicles." W. H. Scott. September 11th.

20,591. "Power control system for automatic switches." Western Electric Co., Ltd. (F. T. Woodward, Belgium.) September 11th. (Complete.)

20,654. "Galvanometers or the like." Cambridge Scientific Instrument Co., Ltd., and W. H. Apthorpe. September 12th.

20,663. "Incandescent filament lamps." J. R. Quain. September 12th.

20,683. "Means of suspending electric supply fittings, terminating, anchoring, insulating, and protecting flexible wires used in connection therewith." B. Deakin. September 13th.

20 703. "Boiling base for a steam cooker which is heated by electricity." E. Welch. September 13th.

20,704. "Electric kettle." E. Welch. September 13th.

20,709. "Apparatus for electrically igniting miners' safety lamps." V. E. Joyce and Spagnoletti, Ltd. September 13th.

20,719. "Apparatus for controlling motors, and especially the motors for working guns." R. H. S. Bacon and R. Redpath. September 13th.

20,725. "Holders for incandescent electric lamps." E. Dobson. September 13th.

## PUBLISHED SPECIFICATIONS.

**Copies of any of the Specifications in the following list may be obtained of Messrs. W. P. Thompson & Co., 285, High Holborn, W.C., and at Liverpool and Bradford; price, post free, 9d. (in stamps).**

### 1912.

Arc Lamps. E. C. R. Marks. (Deutsche Beck-Bogenlampen Ges.) 12,592. May 28th. (Convention date not granted.)

Apparatus for the Production of Electric Power for Use in Connection with Wireless Telegraphy or Wireless Telephony on Aeroplanes and Waterplanes. C. Grahame White and H. Fothergill. 16,192. July 22nd.

Electricity Meters. S. H. Holden and Chamberlain & Hookham, Ltd. 19,118. August 21st.

Telephone Systems. Automatic Telephone Manufacturing Co. (Automatic Electric Co.) 19,251. August 22nd.

Telephone Systems. Automatic Telephone Manufacturing Co. (Automatic Electric Co.) 19,252. August 22nd.

Telephone Systems. Automatic Telephone Manufacturing Co. (Automatic Electric Co.) 19,254. August 22nd.

Electrically-wound Clocks. N. Friedman and I. Friedman. 19,429. August 24th.

### 1913.

Apparatus for the Production of Alkali Metals by the Molten Electrolysis of Alkali Compounds. G. W. Johnson. (Deutsche Gold and Silber-Scheide-Anstalt vorm. Rössler.) 1,933. January 23rd.

Electrical Condensers of the Variable Type. A. E. Watkins. 2,238. January 28th.

Method of Making Sheets, Rods, Wires, Filaments and the Like of Tungsten and Molybdenum or Alloys thereof. Westinghouse Metall-faden Glühlampenfabrik Ges. 3,162. February 6th. (February 9th, 1912.)

Refillable Electric Fuses. J. G. Clemens and Monarch Refillable Fuse Co. 3,573. February 11th.

Distance-operated Mechanisms and Signals on Electric Supply Systems. H. W. Handcock, A. H. Dykes and W. Duddell. 6,772. March 19th. (Addition to No. 6,716 of 1912.)

Electric Clock Control. Allgemeine Elektricität's Ges. 6,934. March 20th. (March 22nd, 1912.)

Electrical Heating Bodies Composed of Non-metallic Resistance Materials. Geb. Siemens & Co. 7,932. April 4th. (April 11th, 1912.)

Flexible Electric Conductors. Western Electric Co. (Western Electric Co.) 10,164. April 8th.

Handles for Hand Lamps and other Articles. S. Stern and British Ever-Ready Electrical Co. 10,597. May 5th. (Divided application on No. 19,318 of 1912, August 23rd.)

Electrical Control Clocks for Trunk-line Switchboards. Aktiebolaget L. M. Ericsson & Co. 11,658. May 19th. (May 21st, 1912.)

Machines for Making Electric Incandescent Lamps. Allgemeine Elektricitäts Ges. 14,433. June 23rd. (June 21st, 1912.)

Control of Series-connected Electric Consuming Devices. R. Franz. 15,502. July 4th. (July 4th, 1912.)

Method of, and Means for, the Production of Alternating, Pulsating or Variable Electric Currents. W. Dubilier. 16,917. July 23rd. (Divided application on No. 14,015 of 1912, June 15th.)